THE Chemical Age

VOL. LXXIII | 24 SEPTEMBER 1955 | No. 1889

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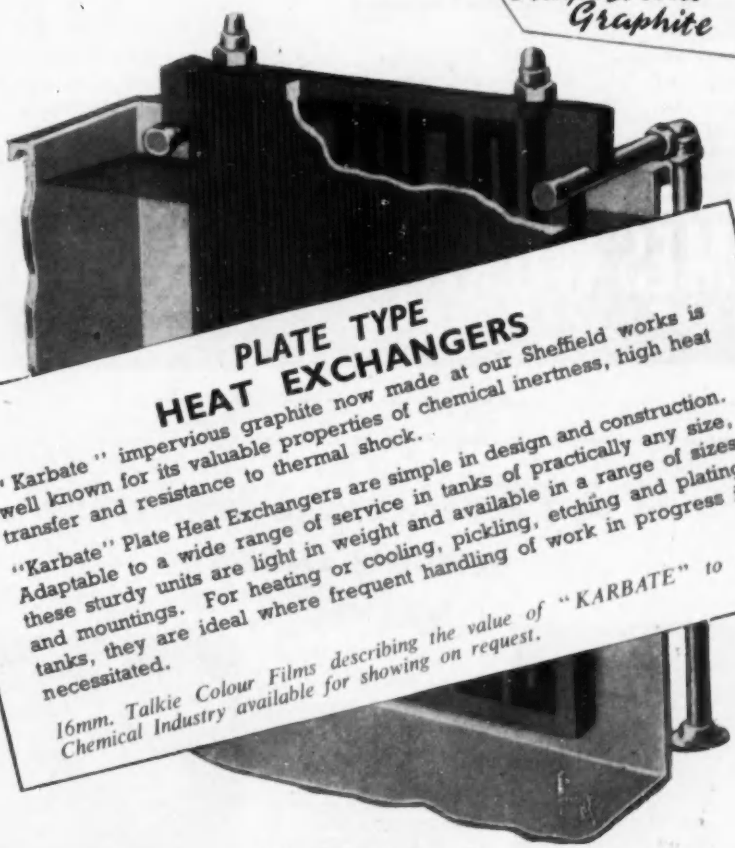

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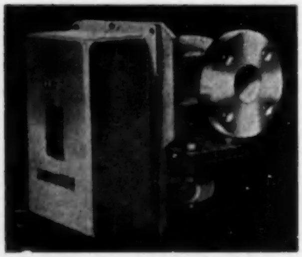

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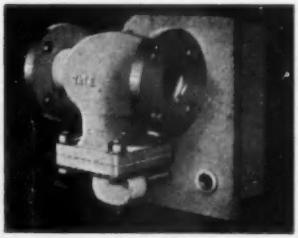

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CONTENTS . 24 SEPTEMBER 1955

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The Anti-Chemical Thesis

CRITICISMS of chemicals used to assist food production seem to make annual rather than perennial outbursts. In the last week or two one such outburst has achieved publicity in the correspondence columns of a particularly influential London daily newspaper, sparked off by an initially brief letter that referred to some mystic 'English disease' and implied that this was caused by chemicals. This school of opinion manages to occupy far more press space than is justified by the minority of persons who adhere to it. At every opportunity that presents itself the familiar letter-by-letter pattern of propaganda is followed; if public policy was determined by letters to newspaper editors, there would by now be no fertilisers, no insecticides, no fungicides, no food preservatives, and instead an enormous amount of human suffering due to starvation.

Let it be granted that every individual has a right to hold and express any faithfully-held opinion. However, the persistent expression of opinions that have been found fallacious whenever they have been examined by independent persons or bodies of persons is one of the nuisance-prices that must be paid for freedom. The anti-chemical letter writers may retort that press columns devoted to this form of freedom are open to all. Unfortunately the evidence that so massively supports the case for most agricultural chemicals requires not an inch or two of print but many volumes; it is evidence that has been slowly and steadily built up over years of careful experimentation. Nothing is easier than the brief and pungent expression of destructive views, and it is difficult to counter these rhetorical appeals to public opinion with similar brevity.

The mental discipline, or rather the lack of it, that is associated with most of these attacks is well enough revealed in the course of each correspondence column campaign. The initial point is rarely pursued. Within a few days what began as a criticism of fertilisers has changed into a criticism of some modern insecticide. All that can be labelled 'chemical' is grist to the same mill. A fragment of evidence that seems to induct one such 'chemical' is regarded as evidence against all of them. This is another reason for the absence of counter-attack from scientists, for it is embarrassing as well as difficult to cope with opponents who deal in one argument on Monday and a totally different one on Thursday. Nevertheless, there is a danger that some members of the public, seeing these 'debates' in the press apparently winning by default, are led to believe that there is 'something in it', that the continued use of agricultural chemicals is maintained by some conspiracy of science and industry.

Attacks upon the use of fertilisers are almost as foolish as voting that the earth is flat or sharing Canute's reported belief that tides can be regally controlled. Fertilisers have been used to increase

crops by providing extra nutrients for well over a century, and throughout their history experiments with fertilisers have been continuing at many centres. There are few subjects in applied science to which so much investigation, much of it patiently repetitive, has been devoted. There has been abundant opportunity for the alleged sins of fertilisers to be revealed—their production of less nutritious foodstuffs, their damage to soil fertility or soil structure, their promotion of plant diseases or pest attacks, etc. But all the research work by generations of independent scientists at a worldwide variety of centres has failed to provide even scanty evidence to support these criticisms; on the contrary, the evidence points in precisely opposite directions. It is true that the misuse of fertilisers—application of excessive amounts or of unbalanced amounts of particular plant nutrients—can produce undesirable effects upon crop quality or soil condition, but no article or appliance is fairly indicted for results of wrongful use.

The much-pressed anti-fertiliser case has been examined from time to time by panels of opinion. The Rowntree-Astor committee formed before the war came to the conclusion that there was no evidence of 'mysterious substances or quality in humus which would affect the health value of plants other than nutrients which could be applied by ordinary commercial fertilisers'. The 1944 Parliamentary and Scientific Committee stated that 'the proper use of fertilisers does not poison soils; it enriches them'. The committee that recently investigated means of using refuse and sewage in farming (see THE CHEMICAL AGE, 1954, **71**, 163) took special pains to examine the argument that British soil fertility has been declining and found that there was no evidence of any such decline over the past 50 years, a period that includes a fourfold increase in fertiliser usage. One of the most devastating refutations of the all-organic non-chemical thesis for plant nutrition was given in 1944 by Sir Edward Salisbury, Director of the Royal Botanical Gardens at Kew, in a paper published by the Royal Horticultural Society. It can reasonably be assumed that many exceptionally delicate relationships between plants and their soils and types of 'food' are encountered at Kew, exposing the use of fertilisers to much more sensitive tests than the production of farm crops. The Dunn Nutritional Laboratories at Cambridge made searching tests to find nutritional differences between crop produce grown on Rothamsted's continuously fertiliser-fed plots and on the similar continuously manured plots, and no differences were found. Indeed, several pages of this issue could be occupied with abstracted accounts of this type of investigation.

Fertilisers are now sufficiently firmly established as essential materials of farming and food production, and it is only in low-using countries such as in Ireland that these exaggerated and unfounded attacks can retard progress. The expansion of the campaign to include all agricultural chemicals on a broad anti-chemical front is more serious for even in well-advanced farming countries the use of some of the more modern chemicals is still in comparatively early stages of development. Public disquiet about toxic risks can easily be provoked. That is not to say that certain new chemicals do not bring new risks, but where this is so scientists themselves, both privately and officially, have been the first to appreciate these risks and call for safeguards.

In this far more complex field of plant protection against pests and diseases a generalised anti-chemical viewpoint is nonsensical. Each chemical must be judged for both effectiveness and safety on the evidence of its own performance and properties. Progress in food production, and especially in lowering its costs can be impeded by irresponsible attacks and criticisms. It may certainly be suggested that reputable newspapers should consider with more care whether their space is justifiably or usefully occupied by wild attacks upon chemicals in general and whether it should not be made a requirement that the chemical substances attacked should be clearly specified, and the practical context of criticism made equally clear. This would not involve suppression of opinion—it would simply create conditions for fair play and reasonable debate.

Notes & Comments

Plant & Equipment

THIS special issue of THE CHEMICAL AGE is devoted in the main to a single but exceedingly wide subject —British chemical plant and equipment. It is more difficult to generalise on this subject than to describe specific developments for today there seem to be more types and classes of chemical plant than species of plants in nature. 'Keep your powder dry' is an old military axiom; 'keep your industrial plant up to date' is its modern counterpart.

Ploughed-Back Profits

WHETHER the current trend for capital to be dearer and credit scarcer will lead to some decline in the home industry's rate of new plant purchase remains to be seen. Much of the cost of new plant in the past 10 years has been met by ploughed-back profits, and there is certainly no firm evidence that this method of financing plant purchase will be less applied. It is true that old plant can sometimes show a 'book' profit, especially for small companies. When initial capital cost has been largely written off by depreciation, this charge against operation is conspicuous by its sudden absence and production costs seem to be pleasantly lowered. Yet in a highly competitive industry this can bring only the briefest satisfaction. Any short-term profit-taking from this cause should be swiftly used for new plant; if not, the ultimate penalty is obsolescence. Some engineers in industry have been highly valued for their ability to keep old wheels turning; all too commonly the end of their careers in a company has been a sorry tale of '*après moi la déluge*'.

A Vital Problem

THE range of materials from which plant can be constructed is steadily widening. The modern study of corrosion has set targets for new alloys and metallurgists have responded to this challenge with remarkable success. In this field of development American research seems to be particularly active; their long-established pre-occupation with chemical engineering and know-how technology is reaping several kinds of harvest and this is one of them. But metals alone cannot tell the whole story. New kinds of glass and even new versions of stone are bringing these oldtime materials of chemical plant back into the forefront of the picture. Recently we learnt about a new glass that can act as its own element in electric heating; it can be bonded to a non-conductive glass to provide external insulation. The present development of this material seems to be confined to electric fire elements and 'self-heated' laboratory glass vessels, but extension into the larger field of chemical plant seems both attractive and feasible. Plastics are steadily improving in versatility and mechanical strength and already there are some problems of plant construction where plastics provide the best solution (see THE CHEMICAL AGE, 1955, **73**, 313). Perhaps the greatest difficulty to be faced by a company determined to keep its plant up to date is to decide what is up to date, to choose the best from the bewildering variety of the new and better. It is probable that there is no other industry in which the need to keep abreast of the times is so vital.

The Rôle of Work Study

THOUGH materials and design decide potential plant performance, a third factor comes into the reckoning for actual performance. The layout of a plant in relation to the works as a whole and also in relation to its own processing stages has a vital bearing upon costs. The application of work-study to old plants has revealed huge sources of saving, sometimes amounting to £1,000 per annum, in relatively small re-dispositions. Work-study investigations on plant already in full operation are perhaps simpler to conduct than anticipatory investigations of plant being built or plant in only pilot or blue-print stages of existence. However, larger companies with well-developed work-study depart-

ments should be able to use their accumulating experience to plan a plant layout that has been 'work-studied in advance'.

Know-How & Research

THE most efficient plant is not the product of a plant manufacturing company alone; it is the product of close technical co-operation between buyer and seller, and in many cases the co-operation of a number of companies is required. Co-operation of this intimacy may be more difficult to obtain for export sales, but experience gained in the home market can still help British plant to compete overseas, provided that there is a willing and progressive attitude towards the export of know-how. The giving of credit is often instanced as a powerful form of competition in the export markets; with chemical plant and processes, the release of know-how is a no less powerful influence. If British chemical plant manufacturers have any weakness this is where it lies. British firms are often slow to release details of chemical manufacturing processes whereas both the Germans and Americans give full details freely. Perhaps one of the reasons is that British chemical engineering research has lagged seriously behind that of both Germany and the US. What, we wonder, has happened to the Bramwell report?

Searchlight on Students

THE latest report from the University Grants Committee, covering the academic year of 1953-54, shows that the number of fulltime students in British universities continues to decline. Some figures for this and other years might well be quoted. 1950-51—85,314; 1952-53—81,474; 1953-54—80,602. No doubt a considerable explanation of the decline is that the backlog of war-delayed university educations has now been dealt with. Even so, it might have been hoped that this loss in numbers would have been compensated by new increases. Yet there have been some increases. Overseas students from the Commonwealth have risen by nearly 400, students from other countries by about 150. So far as this country's own students are concerned, these 'import' gains should be added to the figure for decline, 872. In short, some 1,400 less British students were passing through our own universities in 1953-54.

A Dangerous Trend

IT is difficult to regard these figures as satisfactory. Admittedly universities were overcrowded in the earlier post-war years; admittedly, too, quality of graduate output is as important a fact as quantity. But there has now been a useful amount of university space expansion, and the future prospects of this country depend very greatly upon our having more and more people of higher educational standards, especially in technical and scientific subjects. There should not be this trend of decline. However, a more hopeful aspect of the figures is that the numbers of advanced students in pure science and technology have not dropped, together they rose in 1953-54 by a little over 450. On the other hand the faculty-distribution of university students did not alter significantly, and the percentage of 'arts' students still remained higher at 43 per cent than the total for science and technology, 33.5 per cent. A decline in university numbers that showed some rise in the science/arts ratio would be considerably healthier, but it seems that academic aims still lag behind the obvious requirements of the nation.

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pH Exhibition

COINCIDING with the joint conference on automatic control in the process industries sponsored by The Institution of Chemical Engineers and The Society of Instrument Technology at Caxton Hall, Westminster, London, on 4 October, George Lewi & Partners, industrial consultants, are holding an exhibition of the industrial and laboratory *p*H measurement and control equipment of Electrofact Ltd. at their offices, Hanover Court, Hanover Square, London W.1, on Monday, 3 October, at 4.30 p.m. and Tuesday, 4 October at 5.30 p.m. Admission is by invitation and those interested in *p*H wishing to attend should apply to George Lewi & Partners.

The Epikote Resins Plant at Stanlow

Shell Condensation Polymer in Full Production

DURING recent months increasing interest has been shown by the surface coatings industry in Epikote resins, the new type of condensation polymer developed by 'Shell'. On Tuesday of last week a party of technical Press representatives travelled up to Stanlow, near Liverpool, to inspect the new plant of Shell Chemical Co. Ltd. and to see at first hand some of the special applications of these interesting and versatile resins.

Epikote resins are made at Stanlow by reacting diphenylol propane with epichlorohydrin in the presence of a solution of caustic soda. The diphenylol propane is prepared from acetone and phenol on the site. Both the Epikote and DPP plants were designed by a Dutch team of Shell engineers and incorporate lessons learned in the plants which have been in operation in the US and Holland for several years. The two plants together cost approximately £700,000 to erect and have a rated capacity of approximately 2,000 tons of Epikote resins per year.

The acetone used for the manufacture of the DPP is obtained from Shell's Stanlow oil refinery on the site of which the Epikote plant is located. The epichlorohydrin (ECH) is also produced from petroleum refining gases but at the moment it is being imported in drums from the US.

Seven grades of resins can be produced. These differ in the number of units of DPP and ECH linked together to form the molecule, and the length of the molecule chain can be varied by altering the proportions of these two raw materials in the reaction system The more DPP used the longer the chain. Long chain resins are solids and short chain resins are syrupy liquids.

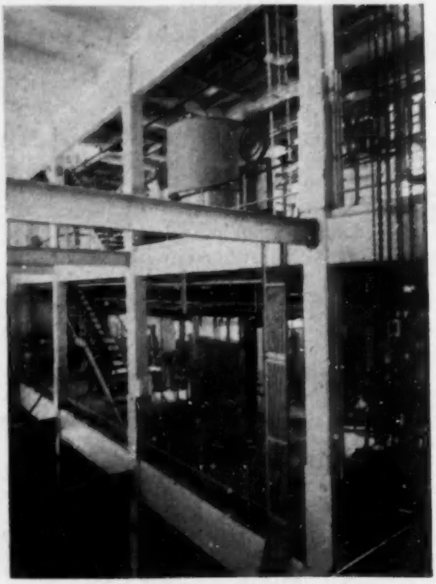
The reaction is exothermic and after stirring for a time the mixture is allowed to settle. The upper water layer contains salt and is skimmed off, while the reaction product is carefully washed to remove all trace of inorganic chlorides. The dry molten resin is run out into stainless steel trays and left for several hours until it solidifies. It is then broken into chunks and passed through a crushing machine to produce a product with a consistent particle size. Before packing in paper-lined sacks the crushed resin is blended in a vertical conical mixer fitted with an upward lifting screw conveyor.

The short chain resins are filtered through a horizontal leaf filter direct into drums.

On arrival the ECH is decanted from the drums and stored in bulk storage tanks. When required the exact quantity needed for a reaction is either weighed out using a stainless steel vessel permanently positioned, or (for the liquid grades) is measured into the reaction stream by a pre-set automatic cut-off displacement meter.

The caustic soda used to dissolve the DPP slurry is received and stored in bulk.

A general view of the Epikote resin unit at the Shell chemical plant, Stanlow



The inside of the plant showing (bottom right) reactors and instrument panel and (top centre) weigh-tank

In making the liquid grade resins the washing of the reaction product is carried out in hydrocarbon solution and the plant includes departments for the reception and storage of toluene and for reclaiming it from the reaction mixture.

The DPP solution is carefully filtered through stainless steel filters before being allowed to enter the reaction vessels and the washwater passes through stone filters.

The two large reaction vessels, each of all-welded stainless steel construction, are each equipped with anchor-type stirrers with cast stainless steel blades and shafts of mild steel clad with stainless steel. Each stirrer is driven by an 83 HP motor coupled to the shaft by a variable speed hydraulic drive. The plant has been designed so that two similar reactors can be installed so that the increasing demand for Epikote resins can be met.

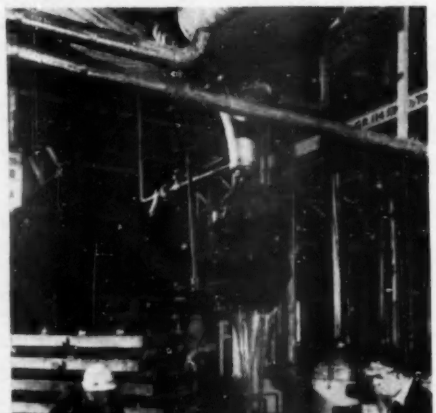
The plant is equipped, wherever possible, with automatic controls. In some cases the temperature recorded controls the flow of the heating material; in other cases the acidity of the wash water is the controlling factor. The wash water is introduced below the level of the reaction product (known as the 'taffy') and is drawn off up a pipe which is controlled so that it is just below the surface of the liquid. Slight positive pressure applied to the vessel causes the wash water to rise through the 'dip' pipe.

One of the reactors will normally be used for the production of liquid grades and is equipped with a reflux head arranged to remove water from the system and to return to the reactor the excess of ECH which is used with these short chain resins. Solvent recovery is effected by reducing the pressure of the system by a vacuum set.

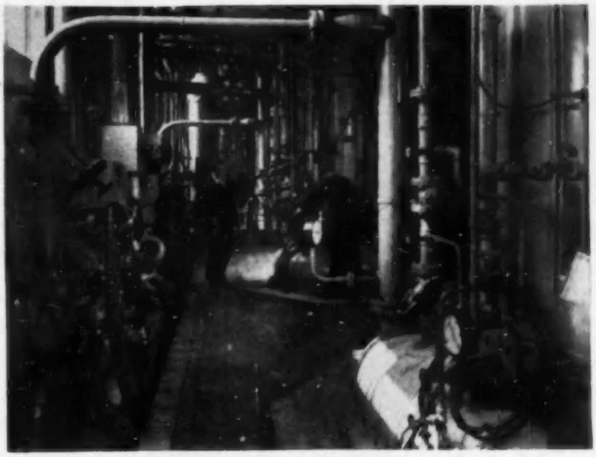
Either reactor can be used for the production of solid grades.

Being an international organisation with world-wide sales, Shell take considerable pains to ensure that their products are uniform throughout the world and this practice has been followed in the manufacture of Epikote resins. Special equipment has been imported from Holland, Switzerland and the US to obtain standardisation.

Laboratory technicians responsible for testing each batch of the resins were trained in Holland by colleagues who have been doing similar work in the Dutch plant for some time. The tests shown to the visiting journalists, and in regular use in the new plant, include the actual formulation of paints and



Epikote resin running out on to stainless steel cooling trays



Operators 'skimming' wash water from the reactor kettles

varnishes and applying them to metal. Test strips or panels are subjected to severe tests for flexibility, chemical resistance and adhesion. In one test a 21 lb. weight is dropped on to the reverse side of a coated panel which is then examined under a magnifying glass to ensure that no flaking or cracking has occurred. Another test is to immerse a coated panel in boiling 20 per cent caustic soda solution for eight hours and examine for loss of adhesion of the film. Liquid grades are given the cold test. A casting of cured resin is cooled to minus 70° C for one hour and then left at room temperature for an hour. This treatment is repeated twice after which the casting must not reveal any cracks.

Applications of Epikote resins in the surface coatings field include coatings for the protection of domestic equipment and industrial machinery, can coatings, tank coatings and chemical resistant finishes for chemical plant. The resins have the general structure shown at the bottom of the page.

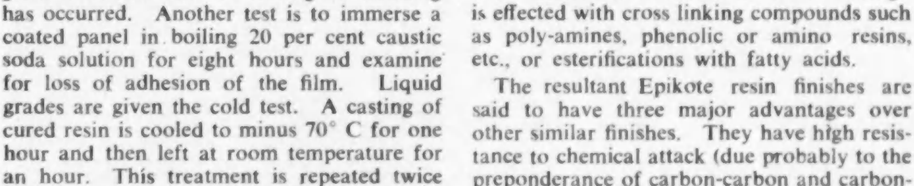
The resins can be manufactured in different grades which vary solely in molecular weight—i.e. in the value of 'n' below. Thus, of the grades supplied, the extremes are respectively a viscous liquid and a hard solid melting at 150° C.

In order to obtain the firm forming properties required in a surface coating, the individual molecules must be joined to form a three dimensional network. This 'curing' is effected with cross linking compounds such as poly-amines, phenolic or amino resins, etc., or esterifications with fatty acids.

The resultant Epikote resin finishes are said to have three major advantages over other similar finishes. They have high resistance to chemical attack (due probably to the preponderance of carbon-carbon and carbon-oxygen bonds), good adhesion and excellent flexibility.

Epikote resin based surface coatings are of special interest to chemical manufacturers, as their properties are ideal for the protection of plant from corrosion.

The new Epikote resin plant at Stanlow has been coated throughout with Epikote resin based finishes. The resin is manufactured in caustic soda solution and therefore the finishes used must be very resistant to alkali. As one of the outstanding proper-



ties of Epikote resin finishes is their resistance towards alkaline solutions, one application will be obvious.

The Stanlow Teepol plant is also protected with Epikote resins. During the manufacture of this detergent very corrosive conditions are prevalent, due to the presence of olefines, sulphuric acid, moisture, etc., and for a long time corrosion was a continual problem. In October 1954 the plant was completely stripped and recoated with Epikote resin based finishes. Since then, it is said, no corrosion problems have been encountered in this plant.

As the finishes used in chemical industry must principally be air-drying, either ester based or amine cured Epikote resin formulations are used. The latter are the more chemical resistant and are used where exceptional corrosion is experienced. Where corrosion is not so severe Epikote resin esters are used. For components of chemical plant which can be stoved, e.g. pump impellers, Epikote/phenolic resin coatings are recommended.

There are a number of important uses for Epikote resins outside the fields of surface coatings, principal applications being for casting and low pressure laminating. For these purposes the low molecular weight grades of the resins are preferred and are generally cured with amine type curing agents.

One of the principal features of glass fibre laminates made from Epikote resins is their high specific strength and resistance to a wide range of chemicals. These laminates are being used for the manufacture of chemically resistant piping and tanks, etc.

The following table shows the results of trials conducted on Epikote resin based finishes:—

Type of Finish	*Where Tested*	*Nature of Corrosion*	*Result*
Linseed ester primer, soya-linseed ester topcoat	Tank externally ..	Atmospheric	Excellent after a year.
Amine cured coating	,, ,, ..	,, ...	Excellent after a year, with slight yellowing.
,, ,, ,, ...	,, ,, ..	Atmospheric + caustic soda spillage	Good after 15 months.
,, ,, ,, ...	Tank internally	Teepol	Good after 12 months (slight patching).
Amine cured coating	Centrifugal pumps ..	15-30 per cent caustic soda at elevated temperatures	Good after 4 months.
Epikote 1007/phenolic	Acid feed pump bases ..	Atmosphere, hydrocarbon and sulphuric acid spillage	Excellent after 15 months.
Amine cured coating	Pumps and motors ..	Tropical, and sulphur dioxide	Excellent after 12 months (previously repainted after 6 months).
Ester primer and two coats vinyl topcoat	Cooling tower, fan pedestal	Waterspray	Good after 2 years.
Amine cured coating	Amonium sulphate plant	Acid solutions due to hydrolysis of ammonium sulphate	Unaffected after 5 months in spite of severe conditions.

Kanigen Nickel Plate

NICKEL plating without the use of electricty is said to be possible using Kanigen chemical nickel plate, a product of Albright & Wilson. Kanigen is a nickel-phosphorus alloy containing about 8.5 per cent phosphorus.

Among many important features claimed for Kanigen are the facts that it will plate on any surface with which it comes in contact and that the variation of thickness is less than 10 per cent of the average, so that it is unnecessary to allow a large safety margin on the thickness of the plate. Therefore, it is claimed, it is possible to plate many articles which cannot be coated successfully by electroplating.

Tests have shown that Kanigen plate is superior in many ways to ordinary nickel plate. For example, in a 20 per cent solution of sodium carbonate the rate of attack on Kanigen plate is 0.006 mil a year, whereas the corresponding figure for electroplated nickel is 0.02 mil a year (1 mil = 0.001 inch).

Kanigen can also be applied to non-metallic surfaces such as plastics, ceramics and glass if the surfaces are specially prepared. To obtain a decorative finish with a high polish, copper may be plated over Kanigen. The copper is then buffed and followed by Kanigen or an electroplated metal.

Control of Batch Distillation Units

by D. C. FRESHWATER, Ph.D., A.M.I.Chem.E.*

THE successful development of continuous distillation operations was made possible by the invention of simple but effective automatic controls (1) and it is now axiomatic that such units should include a fairly comprehensive degree of instrumentation (2). The continuous still with its obvious advantages has now displaced batch distillation plants in many fields. Moreover, due to the somewhat spectacular success of continuous distillation combined with its much greater susceptibility to mathematical analysis, the study of batch operations has been neglected in the past particularly in respect of investigations in the instrumentation of such plants

New Control Techniques

Nevertheless there remain many process applications where batch distillation is to be preferred and it may well be that new techniques of control which are being developed together with the implementation of methods already used on continuous units will not only improve the effectiveness of such applications, but also increase their scope. It is proposed to outline briefly, in this article the principal techniques used in batch distillation and to discuss methods of instrumentation and control of the unit.

Batch distillation may comprise simple vaporisation and condensation with no intermediate fractionation but this is rarely the case and this discussion will be concerned only with the more usual equipment which includes a fractionating column. In its simplest form this is illustrated in Fig. 1.

The kettle is charged with the liquid mixture which is to be separated. This is then heated and the resulting vapours, enriched by fractionation in the column, are condensed, some of the condensate being returned as reflux while the remainder leaves as product. The difficulty of theoretical analysis of batch distillation arises from the fact that as soon as any product leaves the system the composition of the charge, i.e., the feed composition, changes. Thus for a given number of plates and a given reflux ratio, the product composition changes continuously becoming weaker in the more volatile components throughout the course of the distillation.

This may be overcome in practice by selecting a reflux ratio in excess of that required at the beginning of the process so that even when an appreciable percentage of change has been vaporised the product strength is still satisfactory. This implies the production of 'over strength' material in the early stages of operation so that the distillation may be continued beyond the point at which the instantaneous product composition reaches the minimum specification value, and to such a stage that the average product composition is satisfactory.

Alternatively the still may be operated with a continuously increasing reflux ratio to give a constant product composition until the charge and product compositions correspond to minimum plate conditions for the equipment, i.e., the required enrichment can no longer be obtained even at total reflux.

The number of plates and reflux ratio used depend on the charge composition, the product composition and the yield required. The problem is further complicated by the generally deleterious effect of hold up in the

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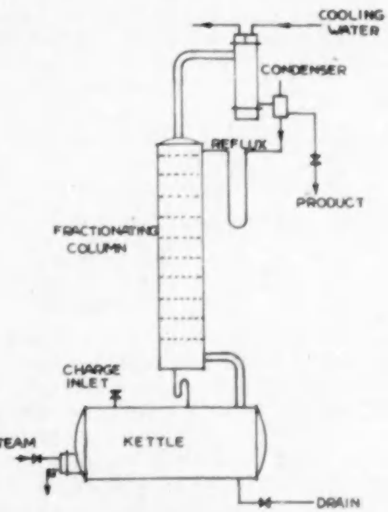

Fig. 1. Simple batch distillation unit

column. The plates require to be supplied with a finite quantity of liquid in order to operate as contacting devices and effect the necessary mass transfer. This must be supplied by vaporisation of the charge and so a certain proportion of the charge is lost making it weaker in the more volatile component, before any vapour (and hence product) reaches the top of the column.

The above discussion has assumed a charge comprising a two component mixture and analytical methods of a more or less rigorous nature have been derived to deal with these problems (**3**), (**4**), (**5**).

However, such mixtures are the exception rather than the rule in practical distillation problems particularly in the field of batch distillation. For multi-component mixtures with finite reflux ratios and hold-up no analytical method of solution has yet been developed owing to the exceedingly complex nature of the problem. However, from the practical point of view, batch distillation units can be designed and operated successfully largely by the application of experience coupled with pilot plant or laboratory tests results. Nevertheless, it will be appreciated from the above discussion that many subtle control problems are involved. This is emphasised if one considers the common methods of operation used to achieve optimum results in the batch distillation of multi-component mixtures.

Generally a combination of the constant and varying reflux techniques outlined above is employed. Thus at the commencement of a run the unit is operated at a predetermined fixed reflux ratio until sufficient yield of the lightest fraction at the correct average composition is obtained. The reflux ratio is then increased to improve the sharpness of separation between this fraction and the next. If the next fraction, say a pure component in the case of a fairly simple mixture, is present in sufficient quantity the reflux rate may be reduced once the product is being made. A similar procedure is adopted at the next 'cut point' and the intermediate reflux rates chosen to give the desired degree of separation to yield.

A variation on this procedure is to operate at total reflux for a short time at the end of each cut so concentrating the intermediates obtained between each fraction into a relatively small volume on the top few plates of the column. These are discharged rapidly, i.e., at a low reflux rate to the intermediates receiver until the next fraction appears.

Clearly it is very difficult to apply complete automatic control to such an operation. While it may be possible to devise a reflux rate controller to operate on a predetermined cycle, apart from the considerable problems this involves from the point of view of the instrument manufacturer, such an apparatus would be of doubtful value since it would apply only to restricted cases and hence detract from the flexibility of the batch distillation unit which is one of its more important advantages. As a starting point, therefore, in considering the instrumentation of batch stills it may be assumed

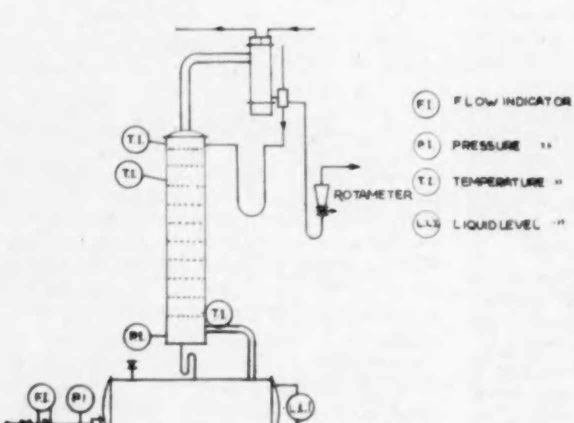

Fig. 2. Typical instrumentation of simple batch still

that such instrumentation cannot fully control the operation. Rather should it be envisaged as assisting in the necessary manual control of the unit and be limited to the control of the few features which can be kept constant during operation.

Fig. 2 shows what may be considered as the minimum instrumentation required for the efficient operation of a batch still, the operation of which is manually controlled and which is working at atmospheric pressure. Little need be said about these instruments except to note that the pressure indicator at the base of the column serves as a sensitive indication of the rate of throughput or column loading and hence as a guide to the amount of heat required. The additional temperature indicator near the top of the column is useful when operating at high reflux rates as it serves to give prior warning of the approach of the column head of a heavier component. Additional refinements may be introduced by the use of a steam flow meter, reflux flow meter and cooling water outlet temperature indicator.

As is usual in distillation control techniques, temperature at a given place (in this case at the column top) is taken as a criterion of the composition at this point. However, the change in temperature for a given change in composition may be quite small, particularly at high concentrations and an alternative method of measurement has been suggested (**6**). This method involves the use of a pressure difference cell into which is sealed a small quantity of liquid of the composition desired at the top of the column. This cell is then immersed in the liquid on the top plate and when the composition of the liquid on this plate is identical with that in the cell, the vapour pressure exerted by both will be the same. Thus the pressure in the cell and the pressure in the column may be connected across a force balance mechanism and used to actuate an indicating or controlling device.

Advantages

The advantage of this is that percentage vapour pressure changes for a given composition change are commonly greater than the corresponding percentage change in temperature. Moreover, the balance is unaffected by changes in the absolute pressure of operation. This latter is a most important consideration in batch distillation where it is common to begin an operation at atmospheric pressure and gradually reduce the pressure of operation as the charge becomes richer in the less volatile component, so as to avoid excessively high temperatures in the kettle.

Automatic Control

Consider now the application of automatic control to this simple batch unit. It has already been argued that fully automatic control of reflux rates is impracticable in most circumstances. However, it may be worthwhile to replace the manually operated reflux system show in Fig. 2 by a flow meter on the reflux line linked by a ratio controller to the product flow. This ratio may be varied by altering the control point of the ratio controller. Thus in effect this system gives remote control of the reflux rate.

One of the most important practical considerations in batch distillation is to operate throughout at the maximum throughput of the column over all condition of composition and pressure, so as to complete a run in the shortest possible time. Fortunately this problem is solved quite easily by a simple automatic control method which depends upon the following argument.

The maximum permissible vapour velocity U_{max} is given by the expression (7):

$$U_{max} = K\left(\frac{\rho_L - \rho_V}{\rho_V}\right)^{\frac{1}{2}} \qquad (1)$$

where ρ_L = liquid density
ρ_V = vapour density, and K is an experimentally determined constant.

For operation at pressures equal to or less than atmospheric pressure ρ_V is small compared with ρ_L, and ρ_L may be considered as being constant.

Thus equation (1) simplifies to:

$$U_{max} = K_1/(\rho_V)^{\frac{1}{2}}$$
$$K_1^2 = \rho_V(U_{max})^2 \qquad (2)$$
$$[K_1 = K(\rho_L)^{\frac{1}{2}}]$$

From fluid flow considerations it is seen that the term $\rho_V(U_{max})^2$ is directly proportional to the pressure drop existing across the inlet and outlet of the apparatus. Thus if the pressure drop across a column is kept at a constant value predetermined for U_{max} under a particular set of conditions this will ensure maximum throughput under all conditions since variations in absolute pressure and composition which directly affect ρ_V will

then be allowed for in determining any instantaneous value of U_{max}.

It is a relatively simple matter to detect the pressure difference across a distillation column and to couple such a detector to a control mechanism. The control mechanism is then used to vary the heat supply to the unit and hence to maintain a boil up rate at its highest possible value throughout a run. A simple diagram of a pressure difference control system applied to a batch still is shown in Fig. 3.

As has been stated it is common practice to operate batch stills at pressures less than atmospheric and this calls for additional instrumentation and control. The 'hook-up' generally used is common to both and may be as shown in Fig. 4. The only important difference between its application in continuous and batch distillation is that in the latter case where distillation begins at atmospheric pressure and ends at a fairly high vacuum the range of the pressure controller must be much greater. This may mean a certain loss of sensitivity.

In addition the mechanics of the detection elements for the pressure controller and pressure indicators are more complex since a variable purge is needed to keep the impulse lines free from condensate under the whole range of pressure conditions.

It has been possible to describe only a few of the more important aspects of instrumentation in batch distillation. Many detailed or specialised applications will occur to the reader. Nevertheless, it is considered that the subject merits further attention in particular with respect to the analysis of the functioning of automatic controls applied both to batch and continuous distillation units. From the point of view of automatic control no distillation plant is continuous in the sense in which the design engineer uses the term. Continuous distillation columns are designed on the basis of steady state condition, i.e., one postulates a known feed strength and reflux ratio and determines the number of theoretical plates required to give products of the desired composition assuming steady state conditions.

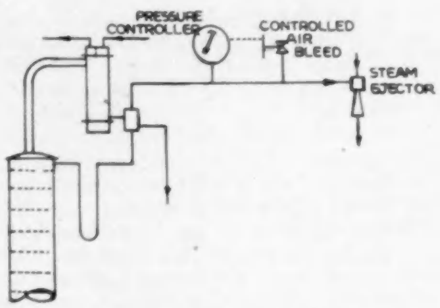

Fig. 4. Simple vacuum control

Such conditions do not exist in practice—if they did instrumentation would not be necessary—and the designer allows for this by including provision for feed flow controllers, reflux flow controllers, etc., to counteract such effects. However, the time taken between a change of an operating condition, its detection, the reaction of the controller and the effect of the controller's action and conditions at the point of detection (through the closed loop) may be and generally is, appreciable.

During such a period the conditions in the column are more nearly those of batch distillation than of continuous distillation. This is an important distinction when attempting to assess the composition change at one section of the column due to a change in conditions at some other section. It is even more important in attempting to determine the dynamical characteristics of the column so that its response to load changes

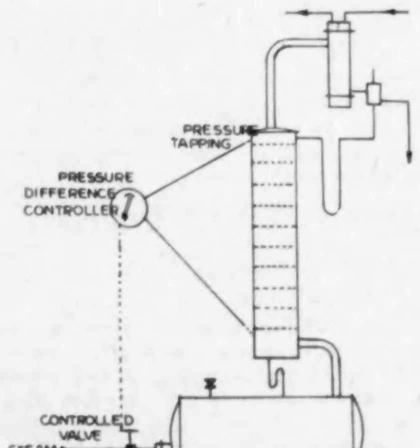

Fig. 3. Pressure difference control of throughput

can be predicted and automatic controls applied scientifically rather than empirically as is so often the case at present.

The development of automatic control even in a field such as distillation where its application has been most remarkable, is limited until the problem of predicting the behaviour of plant in response to process changes has been solved.

In studying this problem as it applies to distillation columns one is reduced to what is basically a study of batch distillation. Design methods for batch distillation are at present very unsatisfactory but in view of its importance both as a processing operation as such and its application to continuous distillation control theory it should be studied actively.

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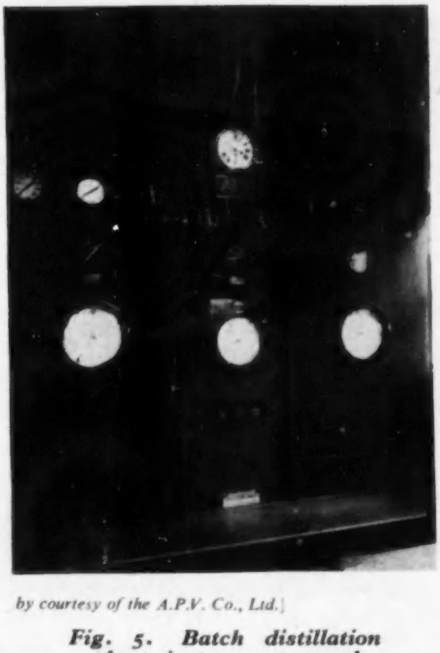


by courtesy of the A.P.V. Co., Ltd.]

Fig. 5. Batch distillation plant instrument panel

[*by courtesy of the A.P.V. Co., Ltd.*

Fig. 6. Benzole batch distillation unit installed at the works of the Barnsley Coal & Coking Co., Ltd.

Plant Contracts

THE Butterley Co. Ltd. announce they have secured a further contract for a large oxygen/nitrogen plant to be installed at the Billingham division of Imperial Chemical Industries. This plant, when completed, will produce 240 tons of high purity oxygen a day, and also 400 tons of high purity nitrogen.

In addition to the above, contracts are in hand for a high purity oxygen plant for Stewarts & Lloyds Ltd., and for smaller plants to be built for the Newport division of The Steel Company of Wales Ltd., and British Celanese.

Hungarian Chemical Works

The Tisza Region Chemical Works, to be built under the second Hungarian five-year plan, will be located in the vicinity of the new power plant to be constructed at Tiszapalkonya, between Miskolc and Debrecen. The chemical works will manufacture fertilisers among other things.

Plastics Materials for Chemical Plant

by J. R. MAJER, Ph.D., D.I.C., A.R.I.C.

IN ADDITION to their most important advantage which is without doubt their resistance to chemical attack, the factors which most determine the suitability of plastics for the construction of chemical plant are the ratio of the tensile strength to the specific gravity and the rigidity. While the values for the former property exhibited by many commercially available filled plastics compare favourably with some of the conventional constructional materials at room temperatures, this advantage frequently disappears at only slightly elevated temperatures owing to the increased tendency to creep exhibited by plastics.

The modulus of rigidity of many plastics is low, but some compensation for this is offered by the greater resistance to shock and vibration. Other properties which must be taken into account when considering the use of plastics materials for the construction of chemical tanks and vessels are their low thermal conductivities and their high coefficients of expansion. The former property may be a drawback and necessitate the incorporation of additional cooling equipment, but in some cases the power of conserving heat may be an economic asset. The latter property demands that some form of elasticity must be incorporated into fixed structures.

Rediweld polythene manifold for fume exhaust plant

No sensationally new developments have been made recently either in the realm of new materials or fresh methods of construction and fabrication. Instead there has been a steady progress in the improvement of established methods and a widening of the field of application of many of the well-known plastics materials. There are six of these, three in the class of thermosetting resins and three in the class of thermoplastic resins.

The most familiar examples in the first class are the phenol formaldehyde resins which in one form or another have been incorporated in chemical plants for many years. They are among the most durable of plastics and are most suitable for the manufacture of acid-resistant tanks which have to stand temperatures above that of boiling water. The maximum operating temperature is quoted at 265° F.

Shock Resistant

When reinforced with acid washed asbestos fibre, phenol formaldehyde resins may be used for the construction of quite large self supporting chemically resistant tanks which can withstand boiling hydrochloric acid. Tanks made from phenol formaldehyde are quite shock resistant and cracks which may develop with age can often be repaired using the uncured resin as a form of mortar.

While resistance to acid conditions is maintained over long periods, contact with strongly alkaline solutions is to be avoided as are alkaline or acid oxidising agents. The filler imposes a further limitation for it is susceptible to attack by hydrofluoric acid and hence tanks made from asbestos-filled phenol formaldehyde resins cannot be used to hold this acid or solutions of its salts. Resistance to these conditions is imparted by replacement of the asbestos with graphite at the

expense of lowering the resistance to impact and rendering the tank electrically conducting a state of affairs which may not be desirable when electrolytic operations are being carried out. The specific gravity of most filled phenol formaldehyde resins is of the order of 1.7 and the tensile strength varies between 3,000 and 5,000 psi.

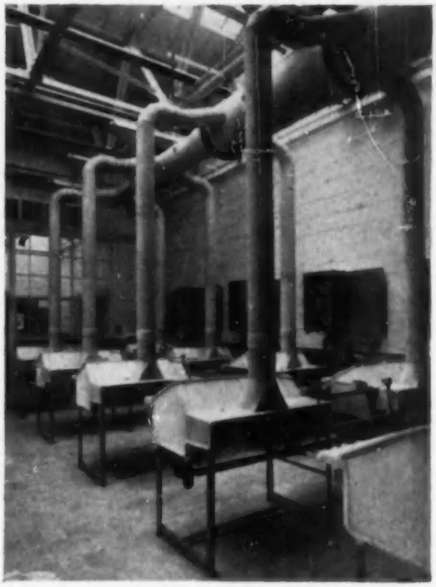
Furan Resins

A class of resins which despite their inferior mechanical properties are replacing phenol formaldehyde resins for an increasing number of applications are the furan resins. These are the acid catalysed polymerisation products of furfuryl alcohol. alone or in admixture with furfuraldehyde. The resulting black materials have certain advantages over other resins when reinforced with equivalent fillers. They are lighter, the specific gravity ranges from 1.1 to 1.6, and they may be used at slightly higher operating temperatures, the maximum being 280° F. The filler which is used depends upon the chemical resistance which is required, graphite is incorporated when fluoride resistance is necessary, but better mechanical properties are obtained with asbestos or woven glasscloth.

Furan products have a greater resistance to attack by alkaline solutions than their phenolic counterparts, but they are not recommended for use with either alkaline oxidising agents such as sodium hypochlorite or acidic oxidising agents such as nitric acid. Tensile strengths are of the order of 2,000 to 3,000 psi, half that of the phenolic resins so that the erection of self-supporting structures is made more difficult. In addition, the curing of furfuryl alcohol polymers must be carried out very carefully in order to avoid brittleness in the final material.

When chemical vessels are being made from either of these thermosetting plastics it is customary to cast the vessel in a series of sections. These may then be machined with normal metalworking machinery and bolted together. Joints which do not have to endure excessive mechanical stresses may be made by using the polymer as a glue and curing it in position with an acid catalyst.

Polyester resins reinforced with glass fibre or woven glasscloth have been used to make vessels which are exposed to less drastic chemical attack. The range of specific gravity of these products is 1.3 to 1.6 and the maximum recommended operating temperature is 200° F. Resistance to attack by organic solvents is only fair when compared with those already mentioned and the plastic is attacked by strong acids and alkalis and oxidising agents. They are, however, capable of withstanding mildly acid conditions and have the great advantage of possessing a very high tensile strength which may reach as high a value as 50,000 psi. The impact strength is also greatly in excess of any other plastic material of construction.

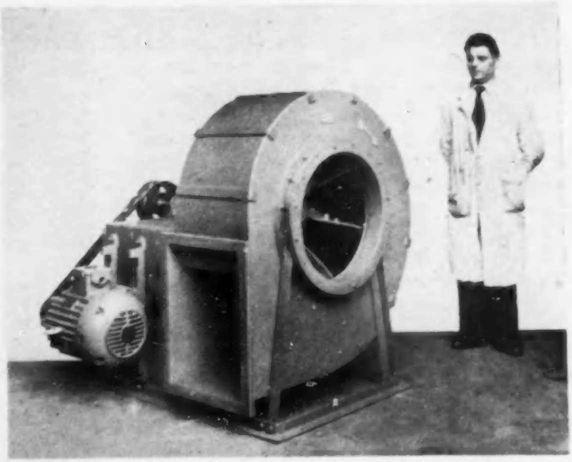


Polythene lined laboratory sinks, polythene drains and polythene exhaust ducts by Rediweld Ltd.

The type of container for which this resin combination is particularly suited is that designed to carry water, neutral salt solutions other than fluorides, and non-polar solvents.

In general, the thermoplastic resins possess greater chemical resistance than thermosetting resins and have also a greater resistance to impact but their rigidity is much inferior, as is the tensile strength. The resins most commonly used are polythene, polyvinyl chloride and polyvinylidene dichloride, but some small use has been made of polymethyl methacrylate and certain copolymers of styrene.

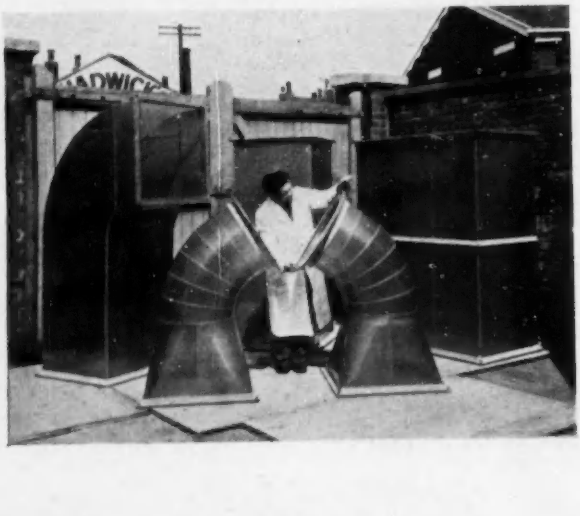
Turbro PVC centrifugal fan 8,000 cfm. The impeller is of the metal paddle blade type completely sealed in rigid PVC and the case is made from ⅜" rigid PVC. Manufactured by Turner & Brown Ltd.



Polythene is the lightest of the plastics materials of construction, being the only one which will float on water. It has a specific gravity of 0.92 and a maximum operating temperature of 150° F. Polythene is the most chemically resistant of all plastics materials used for making chemical vessels, it is not soluble in any organic solvents at room temperatures although it shows a slight tendency to swell in some of them. It is not recommended for use therefore with aromatic hydrocarbons or with chlorinated aliphatic hydrocarbons. Resistance is complete to strong acid or alkaline conditions including fluorides and hydrofluoric acid. Strong oxidising agents attack polythene slowly at ordinary temperatures so that polythene vessels and plumbing can be used even with strong nitric acid provided that contact is of short duration and efficient flushing is possible.

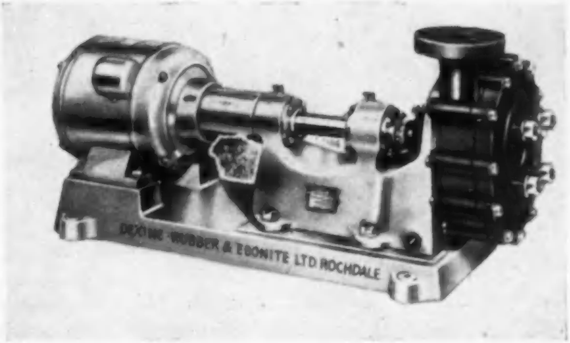
The tensile strength is low, ranging from 1,600 to 1,900 psi, but this is compensated for to some extent by its elasticity and resistance to shock. Its complete lack of odour, taste and smell make it ideal for the construction of containers to be used in the pharmaceutical and food industries where it can frequently with advantage replace stainless steel.

Unplasticised polyvinyl chloride is considerably heavier, but it can be used at slightly higher temperatures, the maximum being 160°F. Its resistance to chemical corrosion is in some cases better than that of polythene, for it does not have the same



Small sections of rigid PVC ducting ⅜ in. thick manufactured for Atomic Energy Authority by Turner & Brown Ltd.

Dexoplas centrifugal chemical pump made by Dexine Rubber & Ebonite Ltd., can handle either hydrochloric acid or sodium hypochlorite



tendency to swell with organic solvents and in addition to withstanding acid and alkaline conditions, it is not seriously attacked by acid oxidising agents. Its outstanding advantage is, however, its dimensional stability which permits working to very close tolerances while making tanks in unusual shapes. The impact resistance is only fair, but it can be improved by blending the polymer with natural or synthetic rubber at the expense of lowering the chemical resistance. Tensile strengths vary with the grade over the range of 5,700 to 8,700 psi.

Polyvinylidene dichloride has had a very limited use in the fabrication of chemical vessels, although it has been used very extensively in chemical plant in America in the form of lined steel pipe. It has a specific gravity of 1.6 to 1.7 and a maximum operating temperature of 170°F. The resistance to organic solvents is quite good with the exception of aromatic hydrocarbons and chlorinated solvents, and it can withstand strongly acid conditions, but it is degraded by the action of strongly alkaline solutions. The limiting property is, however, its low impact strength which becomes particularly apparent at low temperatures. This has restricted the use of the material to small containers which are not subjected to mechanical shock.

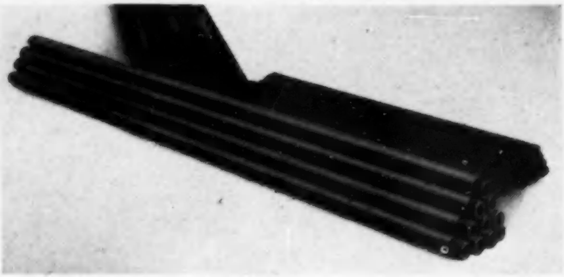
Small vessels such as buckets, floats and crystallisation dishes up to 20 gallons in capacity can be manufactured from thermoplastic resins by injection moulding when the demand for quantity production justifies the initial expenditure upon the moulding machinery. It is quite common, however, to have small vessels made to customers' requirements from the plastic sheet. Joints between sheets and extruded tubing may be made using the technique of hot gas welding.

Quite complicated structures can be fabricated by combining this technique with that of hot pressing of the sheet material. Fabrication in phenolic and furan resins can be carried out in a number of ways. The mixture of resin filler and catalyst may be cast in wooden or metal moulds at room temperature or at temperatures up to 150°C with or without the application of pressure. In general, much better mechanical properties are achieved when pressure is applied and when the cure can be carried out at elevated temperatures.

The cost of equipment for moulding under pressure is high and there have been many attempts to provide cheaper substitutes. The most successful of these is the rubber bag technique by which the resin and filler are pressed on to a former by surrounding them with a rubber bag and exhausting it continuously. This method has also the advantage that it removes the products of condensation as they are formed and promotes complete polymerisation.

Another aid to the casting of vessels with inexpensive equipment is a set of heavy rubber sheets which contain heating elements so that they may be laid over the resin to raise the temperature quickly and conveniently. Vessels of polyester resin are usually made by the vacuum impregnation of mats of glass fibre or woven glasscloth held between male and female moulds. Improvements in the adhesion of the resin to the filler are achieved by applying pressure in the later stages of the cure. Vessels of over 100 gallons capacity are not usually made from the plastic alone.

Thermoplastic materials are used to provide corrosion-resistant liners for metal or wooden tanks. The supporting tank is first erected and the liner tailored to fit it, and



Dexoplus piping also made by Dexine Rubber and Ebonite Ltd. These pipes are made from a high styrene polymer and can be fitted with screw ends if desired. They are resistant to most corrosive chemicals

the two are then anchored together. This method of construction imposes no limitations upon the size of tank, but it is necessary to provide some form of elasticity in the bond if the tank is to be used at elevated temperatures because of the differential expansion of the liner and its support.

An alternative method which has been developed is the flame spraying of the metal tank with molten plastic. This is achieved by blowing a jet of air carrying particles of the powdered plastic through a flame so that the plastic melts without ignition and then impinges in its molten state upon the cold metal tank where it solidifies to form a continuous coating.

The largest vessels which have been constructed in one piece from phenolic and furan resins are of about 600 gallons in capacity; larger units have been made by flanging and bolting together smaller cast sections. Such vessels are usually given additional support with wooden or metal frameworks. Large vessels have also been made by trowelling a mixture of the resin, filler and catalyst on to a support consisting of wire mesh stretched upon metal frameworks and curing the mixture in position. A further method is to build up the shape of the vessel upon a simple former using mats of asbestos impregnated with phenolic resins. Rigidity is achieved by laminating several layers using resorcinol formaldehyde resins as glues. Curing of the felts may be carried out using the rubber heating blankets.

The most valuable and versatile technique which has been developed over the past few years for the fabrication of chemical vessels in plastics is without doubt that of hot gas welding. The welding rod is made of the same material as the sheet stock and is placed at right angles to the join which is to be made. A jet of hot air or nitrogen in the case of polythene welding is directed at the rod and join so that both edges and the rod flow together. The rod and torch are carried along the edges so that the molten bead fills in the gap. It is unusual for the weld so formed to be as strong as the parent material, but the strength can frequently be in excess of 80 per cent.

It is possible with quite simple equipment such as metalworking tools, hot gas torches and facilities for hot pressing to undertake the construction of quite large and complex vessels from polythene, unplasticised polyvinyl chloride and polyvinylidene dichloride sheet rod and tubing. At present, the construction of such plant is in the hands of a few specialist firms, but there is little doubt that more and more of this constructional work will be undertaken by the engineering departments of the users. In the future the ideal corrosion-resisting chemical vessel may well be made of one of the fluorinated plastics, but at present no satisfactory method of fabricating large structures from these inert and heat-resistant materials has been devised.

Reactors for Germany

SPEAKING at Munich on 12 September, Herr Menne of Farbwerke Höchst recommended an early start in negotiations with Britain concerning the purchase of atomic reactors. He also advocated an atomic agreement with the US and establishment of a European atomic energy commission on the lines of OEEC.

Farbwerke Höchst has just announced that it will build at Höchst, just outside Frankfurt, a plant for the manufacture of heavy water. Karlesruhe is to have a 10 megawatt reactor. A smaller reactor for Munich, of the swimming pool type, is to be bought in the US and a third will be built at a later date on the fringe of the Ruhr.

Unit Construction

Developments by Horace Priest Chemical Engineering Co. Ltd.

THE Horace Priest Chemical Engineering Co. Ltd., who hold many patents covering processes and equipment, specialise in standardised unit construction for the chemical and allied industries. They have a large range of interchangeable equipment and components to suit most requirements.

The principle involved is to provide a chassis on which can be mounted any combination of pumps, vessels, heat exchange units, instrument and switchgear panels, etc., to form a neat and complete plant. These unit plants do not require any expensive foundations as they are so designed to be self supporting on simple rafts. According to the processes required, any number of these chassis can be coupled together to form a complete sequence of operations, or a series of different operations.

The equipment is designed so that an extremely large range of processes can be produced by the mere arrangement of components and pipework. These processes cover all forms of distillation for the production of crude or pure products, either continuous or batchwise, and under vacuum or pressure conditions; gas scrubbing, oil stripping, solvent recovery, counter current contact washing, evaporators, reboilers, concentrators, mixing and agitating, fluid heat transmission, and many others, too numerous to elaborate.

To meet the exacting individual requirements demanded by the customer's engineering staff, a comprehensive range of sizes, designed and constructed to a very high standard, is available on short delivery.

FRACTIONATING COLUMNS

A large capacity range of standardised columns, constructed in cast iron and mild steel, or in special materials, are available in shell lengths up to 17 ft. 6 in. long. The shells have no intermediate flanges or manholes, and so provide a leakproof and pressure tight body which is easily lagged with block lagging. Several shells can be joined to give any height.

Bubble trays, which have proved themselves in all forms of distillation to be most versatile for fluctuating loads, are of special design and provide a perfect counter current contact without channelling or hydraulic head, across the tray. Each tray is accurately made to ensure even distribution.

Horace Priest fractionating column cut away to show tray assembly

The tray assembly is inserted and removed from the top of the column, and provides for easy maintenance. Tray spacing can be varied to suit any particular requirement.

As an alternative, any other form of contact, such as rings, grids or proprietary forms, can be fitted to suit requirements. The columns are robust, and are designed for vacuum and medium pressure work.

HEAT EXCHANGE EQUIPMENT

Two types are manufactured—the 'Turbofin' and 'Quadtube'. The 'Turbofin' is a specially constructed segmented longitudinal fin tube element, which promotes high turbulence in low velocity circuits, gives

One of the firm's heat exchangers

high heat transfer coefficients, and is specially suitable for high viscosity and dirty fluids. These tubes provide over 1,000 sq. ft. of heating surface in 15 standard elements requiring only 1 ft. 6 in. by 2 ft. 6 in. by 17 ft. 6 in. space.

The 'Quadtube' element is specially designed for reboiling, vaporising, concentration and condensation. The units are suitable for very high temperature difference, and are fully compensated for reverse expansion. The two circuits are completely isolated, and both can be completely drained. The 'Turbofin' design prevents vapour or liquid locks.

The elements assemble into a self-supporting block unit, and do not require any supporting structure; they can be assembled into any pass arrangement. 'Turbofin' and 'Quadtube' are completely interchangeable, and can be made in most materials. All surfaces can be cleaned in a very short period without completely dismantling, and in most cases, can be cleaned without shutting down the process.

LIQUID HEAT PLANT

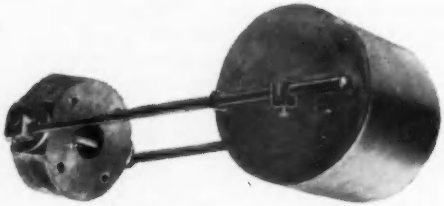
This plant provides high temperature heat at low pressure. It is constructed from direct fired 'Turbofin' heat transfer units, and requires no furnace brickwork or heavy foundations.

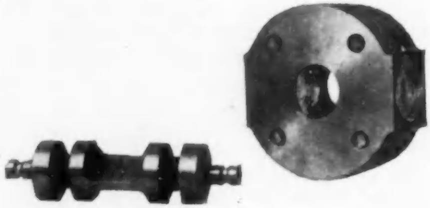
By duplicating these units, large heat outputs can be obtained, and are suitable for the indirect heating of process equipment.

These direct fired 'Turbofin' units are easily transportable, and can be accommodated practically anywhere. The units are also used for heating air and vapour, superheating, and low capacity steam production.

FLOAT CONTROLLED VALVES

A very useful float controlled valve that cannot stick, provides a positive and reliable means for controlling reflux rates, tank levels, and pump flows, etc., has no glands, and the float, which is adjustable, on twin arms, provides a powerful lever arm. The large range of standard valves are constructed in cast iron with heavily nickel plated floats and float arms.





The above pictures show the ruggedness and simplicity of the float controlled valve

Three 7,500-gallon crystallisers, showing motor and reduction gears for driving the paddles, at an anthracene recovery plant designed and built by The Horace Priest Chemical Engineering Co. Ltd.

PROCESS EQUIPMENT

The photograph at the bottom of the opposite page shows an anthracene recovery plant designed and built by The Horace Priest Chemical Engineering Co. Ltd. It consists of three 7,500-gallon paddle type crystallisers; two stage centrifugal extraction units, intermediate agitator type digesters, drained oil tanks from which the oil is blown under pressure to the main storage, and bagging hopper equipment, etc.

All the equipment, except the crystallisers, is housed in a steel framed asbestos sheeted building, which is amply provided with light by reinforced corrugated glass windows.

Other plant designed and manufactured for the coke, gas and chemical industries, are for tar acid, tar bases, naphthalene, benzole, hard pitch and for handling concentrated ammonia, sulphate of ammonia, phthalic anhydride and other tar derivatives.

Dust Extraction System

PNEUMATIC transport of solids usually entails high capital and running costs, even with a well designed system. These costs can be excessive in dust extraction and collection installations where the volume of contaminated air that has to be entrained into a plenum system to ensure satisfactory ventilation far exceeds the volume of air required for the pneumatic transport of the particulate matter suspended in the entrained air.

However, in dust extraction systems designed by Dallow Lambert & Co. Ltd., Leicester, where the collected dust has to be conveyed an appreciable distance to the final disposal point, this tendency has been mitigated to some extent by siting the dust separator as near as possible to the area of extraction and employing an independent pneumatic transport system to carry the dust to the disposal point.

The collected dust is fed into the secondary system by means of a venturi throat. Only the minimum amount of air necessary to prevent dust settling in the ducts is used and this is much less than the volume of air originally entrained, resulting in savings in power and capital costs. Furthermore, this air can be drawn from outside the building and is therefore clean, thus avoiding wear and abrasion on the fan impellor.

Polyvinyl Chloride Plant

The Interministerial Commission for the investment of foreign capital in Argentina has approved two proposals made to establish factories to produce polyvinyl chloride. These were made by Industrias Quimicas Argentinas Duperial S.A. jointly with Imperial Chemical Industries of Great Britain, and by Industrias Patagonicas S.A.C. (Indupa) jointly with La Compagnie des Produits Chimiques et Electrometallurgiques Pechiney of France. The total investment of foreign capital by both groups is equivalent to 25,000,000 pesos when converted at the free market rate of about 14 pesos per US dollar. In addition, the Argentine groups will invest a further 90,000,000 pesos. When operating at capacity these factories will produce Argentina's entire needs of polyvinyl chloride.

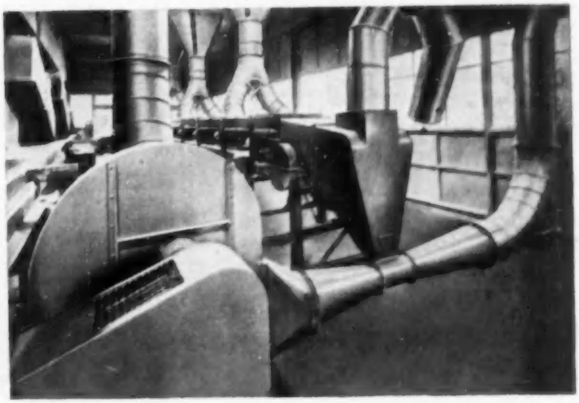


Illustration shows collected dust being conveyed from cyclone cone exits to the pneumatic system via the venturi

Equiverse Furnace

New Principle Gives Good Results

AN ENTIRELY new thermal cycle is incorporated in the Equiverse furnace made by the Incandescent Heat Company of Cornwall Road, Smethwick, Birmingham. This system can be applied to existing or new furnaces, static or continuous, large or small and is said to achieve the following results:—

(a) No metal loss or scale formation while heating plain carbon or alloy steels at temperatures up to 1,300° C, during soaking periods ranging from a few minutes to several hours.

(b) Increased heating rate when operating with a very small temperature lead.

(c) Exceptional heat recovery from the flue gases. Waste gases leave the furnace at below 200° C.

(d) Elimination of scale ensures a clean surface, and hence less wear and depreciation of dies, tools and rolls. Serious loss of metal due to oxidation is also avoided and there is no deterioration of physical properties at boundary layers by inter-crystalline oxidation.

(e) Atmospheric control is automatically regulated to suit the work and operating temperature. Automatic temperature control may also be applied with advantage.

A leaflet (V.30) put out by the company describes some of the uses to which this system can be put, and also compares Equiverse results with those obtained by other means.

Two photographs are reproduced, both of steel billets which have been heated to 1,280° C, one in an Equiverse furnace and the other in a direct-fired gas furnace. No appreciable surface deterioration had taken place in the case of the Equiverse heated billet, but the billet heated by conventional means was corroded and had lost 0.117 lb. of metal per sq. ft.

Stoneware Catalogue

DOULTON Chemical Stoneware is well known in the chemical industry as a material which is resistant to corrosion from all corrosive agents with the exception of hydrofluoric acid and hot, strong caustic alkalis. The latest general catalogue of the company lists the range of products for use in the chemical, pharmaceutical, food and drink, cosmetic, photographic and other industries.

Where high temperature or severe temperature fluctuations occur a grey coloured material is used which, due to the nature of the raw materials employed in its manufacture, is highly resistant to thermal shock.

Large storage vessels are one of the items available. These vessels can be supplied with or without bottom outlet and can be coupled together to form a large storage battery, the interconnecting piping being arranged in such a way that a constant level is maintained throughout the system.

Copies of the catalogue are obtainable on request from Doulton & Co. Ltd., Doulton House, Albert Embankment, London S.E.1.

Gas for Nothing

A SIMPLE and cheap gas generating plant has been developed by a Tyrolean farmer and hotelier. Sufficient gas is obtained for all farm and hotel requirements without any operational costs and the gas produced is said to have a heating value 40 per cent higher than that of ordinary town gas.

Stable manure, garbage and similar waste are placed in a concrete tank which has two openings. The chambers are so arranged that the gas pressure keeps the fermenting matter in continuous motion and a raking device prevents the formation of scum.

No separate pump is necessary for draining of the digested sludge and there is no need for a separate gas container.

Bakelite Trade Fair Exhibits

CENTREPIECE on the Bakelite stand at the British Trade Fair in Copenhagen from 29 September to 16 October will be a motor car body made from glass fibre materials and polyester resins. Also featured will be a variety of laminated materials which are used in the electrical, radio and engineering industries.

Applications made from Bakelite phenolic, urea and alkyl moulding materials will also be shown, together with a range of Vybak plastics. The Vybak plastics as extrusion compounds are used for electrical cable insulation and sheathing for flexible and rigid strip.

Tar Processing

by JUSTIN HURST, Managing Director of Russell Constructions Ltd.

MOST of us know coal as a fuel which we burn in our grates or furnaces, in which capacity it also is used to generate heat for the driving of locomotives and the generation of electricity. In industry, however, this valuable mineral has a much deeper significance. Let us, therefore, take a brief view of the history of coal insofar as it is known to us.

It was about the middle of the thirteenth century that coal was first mined in England, for it is recorded that in 1259 King Henry III granted a charter to the freemen of Newcastle-on-Tyne to carry out this operation.

At the beginning of the fourteenth century coal was being actively mined in Northumberland, Staffordshire and Shropshire, although, curiously enough, at this time its use for industrial purposes in the London area was prohibited by Royal Proclamation.

At the beginning of the seventeenth century coal mining had become one of our major industries and pits had become much deeper, a circumstance which brought about numerous scientific and engineering problems, such, for instance, as the disposal of water which collected in the workings. It was at this time that Thomas Savery, in order to cope with this particular problem, invented the very first steam engine. This engine, attached to a pump, was able to clear the pits of water much more speedily and efficiently than had hitherto been possible.

First Coal Plant

A few years later this engine was very much improved upon by Newcomen, but it was not until late in the eighteenth century that James Watt, partner in the important engineering firm of Boulton & Watt in Birmingham, interested himself in the coal mining industry and produced a really efficient and reliable steam pump. The installation and maintenance of these engines was entrusted to a very skilful and ingenious employee of the company named William Murdoch, who, being thus brought into contact with the mining industry applied himself to a minute study of the then known properties of coal, which culminated in the establishment of the first coal gas producing plant.

Fifteen years later, at the beginning of the nineteenth century, the first public gas works was erected in London to be followed shortly by others in all parts of the country.

It should be explained at this juncture that town gas is produced from coal by heating the latter to a very high temperature in an enclosed space, a process known as retorting. When the coal is thus heated town gas, together with ammoniacal liquor and tar are given off, the residual material being coke.

Formidable Problem

In the early days of gas production the disposal of the large quantities of tar (10-12 gallons of tar to each ton of coal) which was evolved in the manufacture of town gas constituted a very formidable problem. However, it was just at this time that the foundations of organic chemistry as a more or less exact science were being established and researches into the possibility of extracting useful products from the large quantities of redundant tar which were being produced engaged the attention of some of the most gifted chemists of the period.

It was not long before these efforts began to bear fruit. In 1820 Garden isolated naphthalene from tar, a discovery which incited other scientists to still further research in this field and it soon became evident that this hitherto unwanted and troublesome by-product of the gas works was in reality a material from which innumerable valuable and useful chemical compounds could be derived.

After the discovery of naphthalene, phenol (carbolic acid), benzene and a whole host of other chemicals were obtained from tar. The crowning event in this series of discoveries occurred in 1856 when Perkin synthesised his now famous mauve dye from aniline, a derivative of tar, and to commemorate this event a new issue of penny postage stamps was printed in mauve ink made from Perkin's dye. Shortly after this many other brilliantly coloured dyes were produced from aniline.

Later still, many important medicinal

drugs were produced from coal tar products and also compounds which formed the bases of some of our most powerful explosives.

It is thus that coal tar, which appeared first as a redundant and troublesome incidental coal gas product, became one of the most valuable and versatile by-products known to industry, and in order to cope with the huge demand for this vast and exciting array of new chemicals derived from coal tar an entirely new industry came into being, namely that of tar distilling.

Manufacturing Problems

The coal gas undertakings were to discover, though, that if they wished to avail themselves of the revenue to be obtained from the sale of this erstwhile waste product, additional manufacturing problems arose which had to be dealt with.

It should be explained that the tar distiller can only use tar that conforms to a certain standard of purity, and the tar, as it emerges from the gas works retorts usually falls far short of this standard.

In its original state tar contains a certain amount of water and some solid matter in the form of free carbon in quantities that vary from works to works, but the tar distillers postulate a maximum water content of five per cent and a minimum amount of solid material in the tars that they use, and some of the processes involved in freeing the tar from these impurities present quite difficult problems.

At first glance, the operation of extracting water and solids in suspension from a body of tar would appear to present no great difficulty.

A process known as 'Settling' is usually employed. Tar, which we usually think of as a black glutinous mass, when raised to a temperature of 60° C becomes a free flowing oily liquid. In this condition, if left to stand, the solid particles in suspension will sink to the bottom, while the water held in emulsion will gradually float to the top.

The gas works use settling tanks for carrying out this operation. These take the form of totally enclosed vertical cylindrical containers, usually about 30 ft. high and 40 ft. in diameter and having a capacity of 200,000 gallons. Steam coils are situated in the bottom of these tanks whose function is to maintain the tar at a temperature of 60° C and drawing off cocks are fitted to the tank at various heights. The crude tar is ducted to these containers and allowed to settle for a period (usually about two days). By this time any solid particles suspended in the tar will have sunk to the bottom and the water will have floated to the top. This latter can then be drawn off by operating a cock at the critical level and the more or less pure tar can then be drawn off, leaving the solid matter deposited at the bottom of the tank.

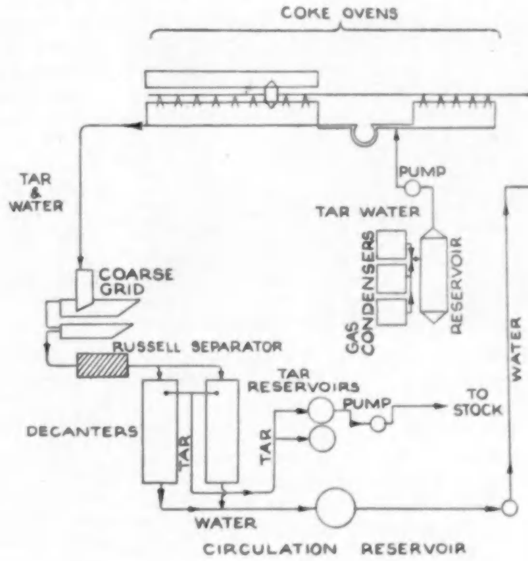
However, after a number of batches of tar have been processed in this manner the accumulating mass of solids at the bottom of the tank will rise to such a level that the heating coils will be submerged by it and, owing to its insulating effect, insufficient heat will be imparted to the tar. The tank is then rendered inoperable until such a time as the deposited solids have been removed and herein lies the great snag in coal tar production for even to-day in spite of all the thought and study that modern science has brought to bear upon the subject, the cleaning out of a tar settling tank is an infinitely dirty, unpleasant and even dangerous job.

The deposits in the bottom of the tank are too viscous to be removed by any form of pumping and are not hard enough for any mechanised form of digger to be employed, so that the job has to be performed by manual workers who enter the tank and carry out this gruesome task under conditions that can only compare to Dante's Inferno.

Interesting Developments

At least such was the case until recently some very interesting developments were carried out at the North Thames Gas Board's works at Beckton. Beckton is the largest gas works in the world and certainly one of the best equipped, its directorate being continuously engaged in study and research of means for improving their processes and products. Naturally enough the bugbear of settling tank cleaning came often under review and on one such occasion it was suggested that if the solid particles could be strained out of the tar prior to its entering the settling tank, the need for tank cleaning would be eliminated.

Unfortunately though, tar, even in its heated condition does not lend itself to any sort of straining process particularly so since the carbon particles to be extracted are so minute in size that a very fine straining element must be employed. In nearly all



Flow diagram of typical coke oven circuit employing a Russell Separator

types of strainer the nature of the tar material itself very quickly causes the interstices in the screen to become clogged up so that for the time being any idea of passing the tar through some form of strainer was considered impractical, until an entirely new form of straining machine attracted the attention of the authorities at Beckton. This was the Russell Separator, a product of Russell Constructions Ltd., of London.

The firm of Russell Constructions Ltd. specialise in sieving and straining plant and gained some repute during the war when their researches into the effects of gyratory vibration in its application to these processes rendered possible and reasonably safe the mass production of dangerous and sensitive explosive compounds.

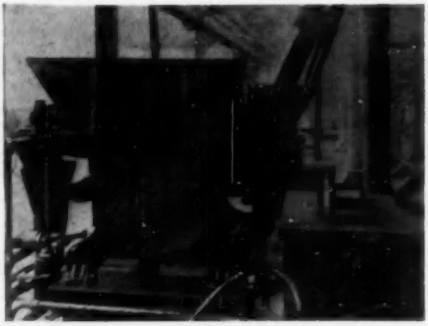
Later on, when the experience gained in these fields was applied to the industrial needs of peace time, the Russell Separator was evolved which immediately gained great popularity as a highly efficient strainer of liquid and semi-liquid compounds.

The Russell Separator operates upon the gyratory principle referred to above, an unbalanced flywheel rotating at a fairly high speed generates the gyratory movement which by means of a special form of suspension is transferred to the screening assembly.

The gyratory movement of a body may be explained as such that, while the body itself does not rotate, any point upon its surface will be describing a circle. In the case of the Separator, the diameter of the circle thus described is about 3/16 in. at a speed of about 1,500 revs. per minute.

The screening assembly usually takes the form of a stainless steel frame having an area of about 6½ sq. ft. which is dressed with a wire mesh. This mesh may be as fine as 200 strands to the inch. Such a screen has a mesh aperture of only three-thousandths of an inch and yet throughputs as high as 12,000 gallons per hour have been attained on this machine. Furthermore, no matter how much solid residue is being strained out of the liquid, it is almost impossible for the meshes to become clogged up or blinded.

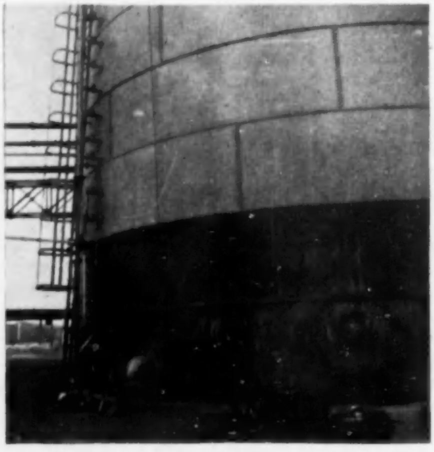
These remarkable results were considered so extraordinary that a special study was made of the behaviour of the material on the screen surface by means of slow motion cinematography. An examination of these recordings showed that under the influence of gyratory vibration a minute, but comparatively powerful vortex was formed in each mesh aperture, so that the liquid seemed to 'screw' itself through the interstices of the screen. At the same time, the interaction of the rapidly rotating vortices caused any solid particles approaching within their in-



A thousand gallons of cleaned tar per hour pours out of this Russell separator

fluence to be violently repelled from the mesh surface.

Needless to say, this very useful device found many applications in industry. Its unique ability to strain all kinds of viscous and non-viscous liquids at a high rate of output with continuous rejection of suspended solids and complete absence of mesh clogging befitted it ideally for such jobs as oil clarifying, fruit and sugar syrup straining, the extraction of oversize fibres from paper pulp, regaining coal from coal washing water, starch production, etc. The engineers at Beckton Gas Works having learned of the reputation of the machine, and always on the lookout for some means of cleaning their tar and thus eliminating the



Typical tar/water decanter tank showing the water drawing cocks. These are operated from the safety ladder

grim business of settling-tank cleaning, decided to test out the merits of the Russell Separator as a tar strainer.

Accordingly, a unit was installed at Beckton in the early part of 1954 and it immediately became evident that this machine had achieved that which had hitherto been deemed impossible. The Russell Separator performed perfectly.

The tar, as it emerges from the condensers at a temperature of about 80° C after a rough separation is passed by the Russell Separator through an 120 mesh screen at the rate of 1,000-1,500 gallons per hour, while the separated solids which amount to about 7 lb. for every ton of strained tar are ducted away via the reject outlet of the unit.

When the tar strained by this process was treated in the settling tanks it was found that the water in emulsion tended to separate out much more readily than had been the case heretofore, but the culminating event occurred when, after the separator had been running for twelve months and had passed about 10,000,000 gallons of tar to the settling tanks, it was decided to investigate the condition of the inside of the tanks since it was known that in default of the separator these should have been completely silted up after settling out this vast amount of material.

The results of this examination, however, completely vindicated the enterprise and sagacity of the Beckton engineers for it was found that the tank was completely free from silt.

New Element

AT THE XVIII Conference of the International Union of Pure and Applied Chemistry, Zurich, Switzerland, 20-28 July, 1955, the Commission on Nomenclature in Inorganic Chemistry recommended that element 101 be named Mendelevium, symbol Mv, based on claims of Messrs. A. Ghiorso, B. G. Harvey, G. R. Choppin, S. G. Thompson, and G. T. Seaborg of the University of California, announced in UCRL-2943 (contract No. W-7405-eng-48) 'The New Element Mendelevium', 4 April, 1955, in a report printed for the Atomic Energy Commission.

The Council of IUPAC has approved the recommendation of the Commission on Nomenclature in Inorganic Chemistry.

Furnace Control

Elcontrol Safeguard Equipment

SAFE lighting-up procedures for practically all types of gas and oil fired furnaces are claimed to be obtainable with the furnace safeguard units type FSM1 and FSM3 made by Elcontrol Ltd. Protection against flame failure while running is also provided. Type FSM1 is for use with manually controlled, spark-ignited gas and oil burners and type FSM3 for controlling automatically spark-ignited gas and oil burners under the on-off demands of a thermostat or time switch.

Two alternative methods of flame detection are used in the FSM units. The first system employs an infra-red sensitive cell mounted on a viewing head, the head being installed so that it always 'views' the flame. It is characteristic of all flames that they emit a fluctuating level of infra-red radiation. This is detected by the sensitive cell which then transmits a fluctuating signal to the control unit. This signal is amplified by the control unit and is used to energise the flame relay which in turn provides for control of signal lamps, fuel valves, etc., as called for. The control unit ignores a steady signal, such as that from a hot refractory, and this type of signal will therefore not operate the control unit.

The second system, which is generally less satisfactory in operation employs a heat resisting steel probe so installed that the tip of the electrode is always in contact with the flame. The electrode has a small potential above earth and as flames are partial conductors a varying or modulated current will flow in the circuit between electrode, flame and earth and back to the control unit which then operates as previously described. Disadvantages are the relatively short life of the electrode and the difficulty of installing it correctly.

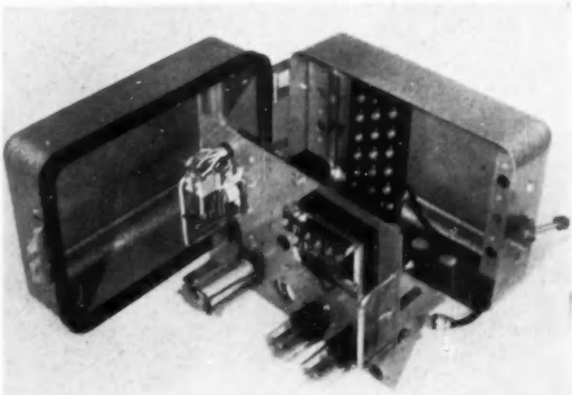
Precious Metals

THE chemical compounds of the precious metals have been among the products of Johnson, Matthey & Co. Ltd. since the early days of the company, says a recently issued catalogue, 'Chemical Products'.

A high standard of purity and uniformity is claimed for all Johnson, Matthey products. This is best exemplified, they say, by the company's range of spectrographically standardised substances. A range of metals, oxides, salts and solutions is now available representing 68 of the chemical elements. Slight variations in the degree of purity from batch to batch are inevitable but a detailed report is sent with every supply of material.

The importance of complete freedom from residual radioactivity in certain types of research has been recognised by Johnson, Matthey and many of their special chemical products can now be supplied with a level of residual radioactivity below the minimum which can be detected.

Among metals listed in this catalogue are: silver, gold, platinum, palladium, iridium, osmium, rhodium, ruthenium, together with many compounds of the minor and rarer metals. A range of rare earth element oxides is also available.



FSMI Flame Failure Control Unit

Receiver-Indicator

Foxboro-Yoxall Add to Range

FOXBORO-YOXALL, Lombard Road, Merton, London S.W.19, have now added a receiver-indicator to their range of Consotrol recorders, controllers and indicators. The new instrument is designed for use in those applications where a permanent record is not required. The Receiver-Indicator is available in a number of models coded as M/5301 to M/5304 which between them provide actions covering a wide range of applications.

The simplest has a single pointer to indicate the measurement of one variable. From there, pointers may be added to provide indication of two measured variables, indication of the valve position and indication of the set point. A transmitter for the manually operated set point may also be included which will remotely position the control point of an M/58 or M/59 controller. A switch may be incorporated to provide for remote manual operation of the control valve by permitting withdrawal of the controller without disturbing the piping.

The Foxboro-Yoxall receiver indicator

Further combinations may include the Pneumaticset or ratio sub-panels as illustrated. The Pneumaticset, for Cascade type indicating-controlling systems, uses the 3-15 psi. output signal of a primary pneumatic controller to position the set point of a secondary controller. The set point may also be positioned manually from the sub-panel. The ratio sub-panel with manually adjustable ratio setting is used when it is required to maintain the set point of a secondary controller in a given ratio to the primary variable.

The Receiver-Indicator, which occupies a panel space of only 6 in. by 6 in., has a clearly marked scale on its face which takes the place of the chart and chart mechanism used in the M/53 Recorder with which in all other respects it is identical. In fact the Indicator can be easily converted into a Recorder should the need arise.

Hydraulics Laboratory

A HYDRAULIC machinery laboratory which, when completed, will be one of the most advanced research buildings of its kind in the world, is now in use at the new town of East Kilbride, Lanarkshire. The new building is part of the Mechanical Engineering Research Laboratory, which is under the direction of Dr. D. G. Sopwith. It has been built for the Fluid Mechanics Division of MERL, and is 60 ft. high and consists of a basement and two floors with a working area of 28,00 sq. ft.

Basic and applied research complementary to that being done in industry will be carried out within the laboratory, the building and equipping of which will eventually cost more than £600,000.

The problems to be dealt with range from low-speed aerodynamics and hydraulics to complex fluid flow. Already in use are the aerodynamics laboratory and the oil and special fluids laboratory, while open and closed circuits are being provided for research on pumps, turbines, and associated equipment such as valves, pipes, and ducts. Facilities will also be available for research on cavitation and for calibrating flow-measuring instruments.

Developments by QVF

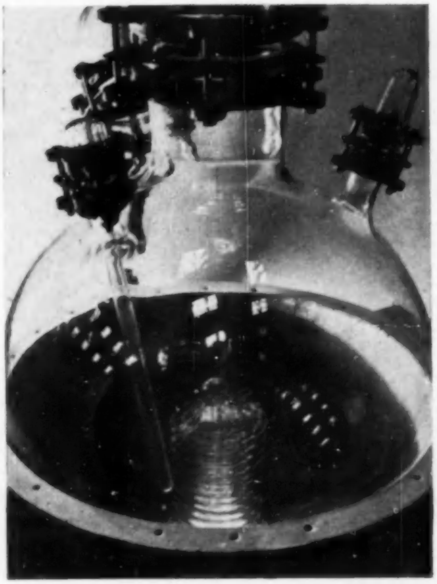
Pressure & Heat Control

'THE chemical industry, having recognised the unquestionable chemical stability of borosilicate glass, has been urging us for a number of years to design a glass pressure relief valve' says the QVF Company, of Stone, Staffs. As a result they claim to have produced a valve that is suitable for use under the most rigorous conditions, i.e. for such operations as halogenation.

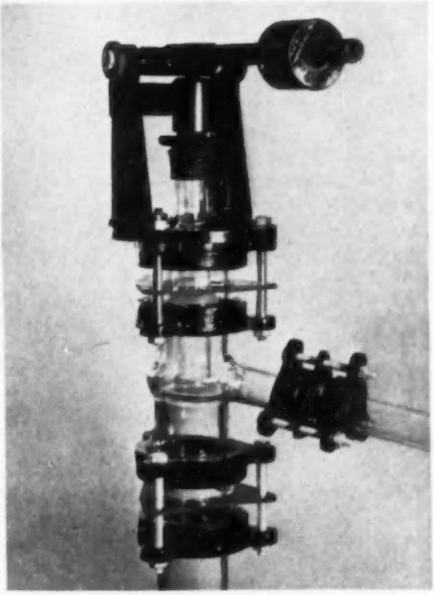
QVF believe that this simple and robust valve will be welcomed by all who have to deal with over-pressure of corrosive gases and vapours. The unit has been tested exhaustively, both in the company's laboratory and in a number of chemical plants.

The valve seat is non-lubricated, no springs are used and the pressurised gas does not come into contact with metal.

Control of an exothermic reaction is a problem that has always beset the chemist. This problem has been intensified with the increasing size of glass chemical plant, since the outside surface area of a spherical vessel does not increase in proportion to the volume.



QVF Immersion Heat Exchanger



QVF Pressure Relief Valve

The development department of QVF considered the possibility of introducing heat transfer elements inside the vessel, and they have produced a unit which, they believe, greatly simplifies operation control and offers a method of heat transfer which is independent of the containing vessel walls.

In normal use the heat exchanger is admitted into the vessel through a six inch bottom opening, with the cooling element disposed just below the liquid level when the vessel is half full.

One possible method of operation is to support the vessel in an electric heating mantle which is used to start the reaction, later controlling it by varying the water throughput to the immersion heat exchanger.

Though primarily designed as a cooler for exothermic heat, the unit is also suitable for use as a steam heater. Steam can be applied for the initial heating and commencement of reaction, followed by introduction of water for subsequent control. The unit can also be used in conjunction with an electric heating mantle to accelerate heating up time.

The fluid passages in this unit have been sized and shaped to allow safe clearance of

condensate when steam is used in the coils, says the company, though it is necessary to exercise the precautions normal to operation of glass heat exchangers. When using the unit as a steam heater it is important that the whole coil be immersed in liquid.

At present the heat exchanger is available in sizes suitable for 50, 100 and 200 litre vessels.

Paxman Filters

A FILTER designed and suitable for the removal of small amounts of fine solids from a variety of liquids is manufactured by Davey Paxman & Co. Ltd., of Colchester, Essex. Two of these Paxman Precoat Filters, have recently been installed in a well-know chemical works in Lancashire.

Each filter has an effective area of 420 sq. ft. with a drum of 9 ft. 6 in. diameter and 14 ft. long. The filter is of the deep submergence type; approximately 55 per cent of the drum surface being submerged.

Filtration takes place through a layer of diatomaceous earth about 3 in. thick deposited on the drum surface. A scraper knife is so arranged that it moves towards the drum surface at the rate of about 1/1,000 of an inch per minute. The knife not only removes the filter cake formed during the preceding revolution of the drum, but also shaves off a thin layer of the diatomaceous 'precoat' and thereby exposes a clean, new filtering surface before commencement of the new filtration cycle.

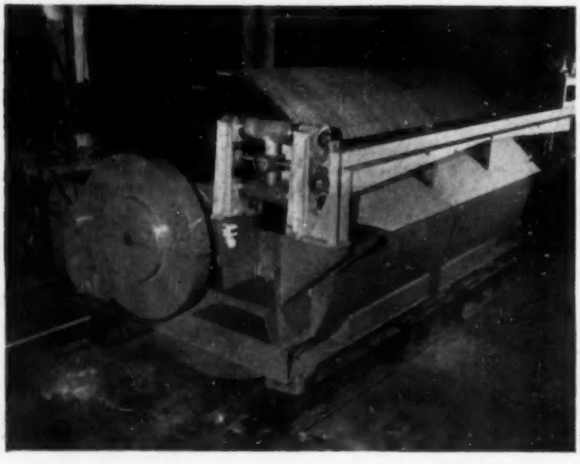
Antibiotics Conference

THE first International Conference on the use of antibiotics in agriculture will be held in Washington from 19 to 21 October. Invitations to participate have been extended to 44 research scientists in Europe, South Africa, Australia, Central and South America and the US. The conference is sponsored by the US National Academy of Sciences National Research Council and supported by four of the largest agricultural research and chemical manufacturing concerns in the US, the American Cyanamid Co., Merck & Co., Charles Pfizer & Co., Inc., and E. R. Squibb & Sons.

Dr. Ted Byerly of the US Department of Agriculture Research Centre at Beltsville, Maryland, is chairman of the committee planning the meeting. It is expected, he said, that this conference will bring world-wide information up to date on the impact of antibiotics in the field of animal nutrition and food production. The US has made great strides in their use in feeding formulas, and there is indication that their impact will be equally great in the vegetable and processing fields. The conference will concern itself primarily with the effect of antibiotics on plants and animals which provide food.

Uranium Discovery in Norway

Uranium has been discovered in a remote district of Finmark in northern Norway. Measurement of the radioactivity of the samples taken shows 0.5 per cent uranium.



A Paxman Precoat Filter installed in a Lancashire chemical works

Nuclear Power Equipment*

by MARTIN FRISCH,

Vice-President & General Manager,
Equipment Division,
Foster Wheeler Corp.

ANTICIPATING the probability that important amounts of nuclear fuels might soon be available to industry, Foster Wheeler Corporation some time ago undertook to estimate and forecast the immediate and longer term effects of potential improvements in reactor technology and other nuclear energy developments on future demands for conventional and nuclear fuel-consuming electric power generating units and for the associated steam producing equipment.

* *Previously printed in "Heat Engineering," May-June 1955 and reprinted by permission of Foster Wheeler Corp.*

Fig. 1. Forecast of plant capability and load growth trends in US electric power industry

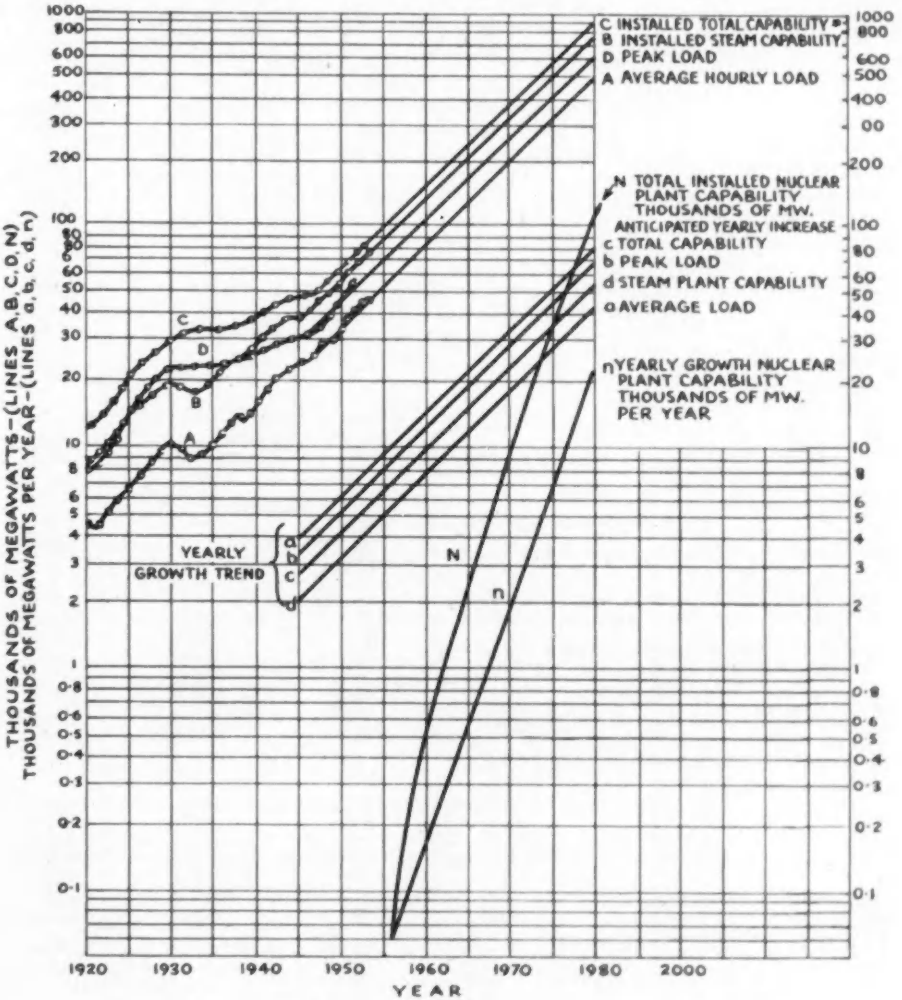


Figure 1, based on published statistics of the Federal Power Commission, quoted by the Edison Electric Institute, shows curves of (A) actual average hourly electric power production rates; (B) peak load requirements; (C) total and (D) steam electric plant capabilities of the electric industry of the United States for the years 1920 till 1953, in thousands of megawatts. Estimates of future trends from 1953 till 1980 are shown by the projections of the lines indicating trends from 1945 until 1953. The slopes of these trend lines suggest that the average hourly load of electric industry might double about every eight years and that by 1980 peak requirements might reach 800,000 MW. and installed plant capability about 900,000 MW.

At year end 1953, the installed capability was 95.5 MW. The corresponding growth trend lines (a) (b) (c) and (d) forecast and suggest yearly increase rates. During the 1949-1953 five-year period, total plant additions were made at an average rate of about 9,000 MW per year and steam plant additions at an average rate of about 7,000 MW. On the basis of the projections, plant additions could average 68,000 MW, and steam plant additions about 45,000 MW per year during the 1976-1980 five year period.

Our guesses forecasting year to year increases in hourly capabilities of nuclear steam electric steam stations are suggested by Line n, and the corresponding total capability of nuclear fuel fired units estimated to be operative each year till 1980, by Line N. The estimates were based on the following assumptions:

a. The first nuclear fuel-fired steam station unit with an electric output capacity of about sixty megawatts will be operative late in 1956, or early 1957.

b. Industry will contract for additional nuclear units at yearly rates increasing year by year to one-half of the forecast total steam plant capability addition rate of 54,000 megawatts estimated to become operative in 1980.

If the average capability per unit is taken as 200 MW, the number of units operative by 1960 might be 2; by 1965, 12; by 1970, 40; by 1975, 160; and by 1980, 590. The number added during each five-year period from 1965 till 1980 might be 2, 10, 27, 120, and 430, respectively.

Rough estimates of the total value, in millions of 1953 dollars, of the potential future United States business in conventional and nuclear fired steam electric power stations and steam generating units thus forecast are suggested in Tables 1 and 1-A. The estimates are based on the following assumptions: (a) the average station cost in 1953 dollars per KW of conventional steam plant capability, uncorrected for the effects of possible technological developments or

Table 1 (opposite): Estimated list of anticipated future US steam plant requirements

TABLE 1A

Demand Forecasts—Steam Plant Additions, 5-year Averages

5-year period		1956-60	1961-65	1966-70	1971-75	1976-80
Steam plant capability additions, 1,000 MW.	F	42.0	70	84	126	134
	N	0.5	2	6	24	86
	T	42.5	72	90	150	220
Total number of units of 200 MW. capability added, average number per year (shown in parentheses)	F	208 (42)	350 (70)	420 (84	630 (126)	670 (134)
	N	2 (<1)	10 (2)	30 (6)	120 (24)	430 (86)
	T	210	360	450	750	1,100
Average yearly value of additions (millions of 1953 dollars)						
Steam-electric stations	F	1,260	1,745	2,695	3,730	4,175
	N	50	108	328	1,040	3,490
	T	1,310	1,853	3,023	4,770	7,665
Steam production plants	F	615	1,208	1,625	1,831	2,047
	N	35	78	228	688	2,133
	T	650	1,286	1,853	2,519	4,207
Steam generating units (including firing equipment)	F	220	312	407	642	741
	N	10	41	170	361	1,166
	T	230	353	577	1,007	1,907

F = Fossil. N = Nuclear fuel. T = Total = F + N.

TABLE 2.

Owners' Cost for Engineering, Manufacture and Erection of Fuel Burning and Steam Generating Equipment only.

1953 Dollars per KW.

Year	1960		1965		1970		1975		1980	
Type of fuel	F	N	F	N	F	N	F	N	F	N
Engineering (B)	—	1.5	0	1.0	0	0.9	0	0.7	0	0.6
Design and development (A)	1.8	13.5	1.8+	9.0	1.8+	8.2	1.8+	7.4	1.8+	6.2
Fabrication	14.7	70	14.0	63	14.6	53	14.6	49	14.6	42
Erection	8.5	30	8.5	25	8.5	20	8.5	19	8.5	17
Total	25	115	24.3	98+	249	82.1	25.1	76.1	25.1	65.8

+ = Fossil fuel fired. N = Nuclear fuel fired. B = Before purchase. A = After purchase.

YEAR	1953			1960			1965			1970			1975			1980		
TYPE OF FUEL (F = FOSSIL, N = NUCLEAR, T = TOTAL)	F	N	T	F	N	T	F	N	T	F	N	T	F	N	T	F	N	T

CAPACITY INCREASE—FORECAST—THOUSANDS OF MEGAWATTS OPERATIVE IN YEAR

	1953 F	1953 N	1953 T	1960 F	1960 N	1960 T	1965 F	1965 N	1965 T	1970 F	1970 N	1970 T	1975 F	1975 N	1975 T	1980 F	1980 N	1980 T
NET ALL PLANTS			7			14			22			33			52			81
NET STEAM PLANTS	5.4	0	5.4	9.8	0.2	10.0	14.4	0.6	15.0	21.0	2.0	23.0	28.0	7.0	35.0	27.0	27.0	54.0
REPLACEMENTS *	.2	0	.2	0.5	0	0.5	0.7	0	0.7	0.9	0.2	1.1	1.5	0.2	1.7	2.3	0.2	2.5
TOTAL ADDITIONS	5.6	0	5.6	10.3	0.2	10.5	15.1	0.6	15.7	21.9	2.2	24.1	29.5	7.2	36.7	29.3	27.2	56.5

ESTIMATED COST TO OWNER OF CAPACITY OPERATIVE IN YEAR—MILLIONS OF 1953 DOLLARS

				1953 F	1953 N	1953 T	1960 F	1960 N	1960 T	1965 F	1965 N	1965 T	1970 F	1970 N	1970 T	1975 F	1975 N	1975 T	1980 F	1980 N	1980 T
FOR ENTIRE STEAM ELECTRIC PLANT ADDITIONS				810	0	810	1500	60	1560	2190	156	2346	3180	500	3680	4280	1580	5860	4250	5400	9650
FOR STEAM PRODUCTION PLANT ADDITIONS ONLY				398	0	398	735	44	779	1081	113	1794	1570	342	1912	2105	1021	3126	2043	3244	5287
COMPLETE STEAM PRODUCTION PLANT	ENG DESIGN DEV	ENG. ARCHITECT (B = BEFORE PURCHASE, A = AFTER PURCHASE, T = TOTAL)	B	0.8			25	02		22	06		31	17		42	51		41	16	
			A	24.0			48	18		70	54		101	15		137	45		133	133	
			T	25	0	25	50	20	52	72	60	78	104	17	121	141	50	191	137	149	286
		EQUIP'T. CONTRACTORS	B				.4				09			2.7			8.2			24	
			A				3.2				8.1			25			74.6			237	
			T	30	0	30	52	4	56	75	9	84	110	28	138	146	83	229	142	261	403
	MAT. INCL. FUEL INV.	FABR & DELIVERY		215	0	215	394	21	415	583	54	637	848	166	1014	1130	506	1636	1102	1622	2724
		ERECTION		73	0	73	137	8	145	201	22	223	292	67	359	392	200	592	380	658	1038
	OWNERS CONTINGENCY & OVHD			55	0	55	102	9	111	150	22	172	216	64	280	296	182	478	282	554	836
	TOTAL			398	0	398	735	44	779	1081	113	1194	1570	342	1912	2105	1021	3126	2043	324	5287
	DOLLARS PER KW			71		71	71	220	74	72	188	76	72	160	79	71	142	85	70	119	93
FUEL BURNING & STEAM GEN. UNITS ONLY	ENG. DESIGN DEV EQUIP'T CONTRACTOR			10	0	10	19	3	22	28	6	34	41	20	61	55	58	113	54	184	238
	MATERIALS FABR DEL			81	0	81	151	14	165	211	38	249	320	116	436	432	355	787	430	1135	1565
	ERECTION			47	0	47	87	6	93	128	15	143	185	45	230	251	140	391	249	460	709
	TOTAL			138	0	138	257	23	280	367	59	426	546	181	727	738	553	1291	733	1779	2512
	DOLLARS PER KW			25	0	25	25	115	27	24	98	27*	25	82	30	25	77	35	25	65	44

* USE 40 YEAR REPLACEMENT AGE FOR "F" EQUIPMENT
USE 10 YR. REPLACEMENT AGE FOR 1970 "N" EQUIPT, 15 YR FOR 1975 "N" EQUIPT, 20 YR FOR 1980 "N" EQUIPT

E

changes in the value of the dollar, will remain at present average of $145, with corresponding steam production plant and steam generating unit cost of $71 and $25 per KW respectively; and (b) that the average station cost of nuclear plants will gradually decrease from $300 per KW of electrical capability in 1960 to $189 in 1980, with corresponding steam production plant unit costs decreasing from $200 to $119, and steam generating unit costs decreasing from $115 to $65.

Five-Year Averages

On the basis of these assumptions Table 1-A suggests that the five-year averages of the yearly values of electric steam station additions might increase from about 1,300 to 7,700 millions of 1953 dollars between now and 1980. During this same period, the five-year averages of the number of units added per year at 200 MW per unit might increase from about 42 to 220 and the corresponding five-year averages of the yearly values of steam generating unit additions from 230 to 1,907 millions of 1953 dollars.

Table 1-A also suggests the relative requirements for conventional fuel and nuclear fuel fired stations and equipment, and confirms the probability that potential demands for conventional fossil fuel fired plants will continue to increase, in spite of any programme now visualised for substituting nuclear plants for other types.

The dimensions of the engineering, manufacturing, and construction tasks to be anticipated on the basis of our forecasts by suppliers and constructors of nuclear and conventional fuel-fired steam generating units are suggested in Table 1 (on p. 663).

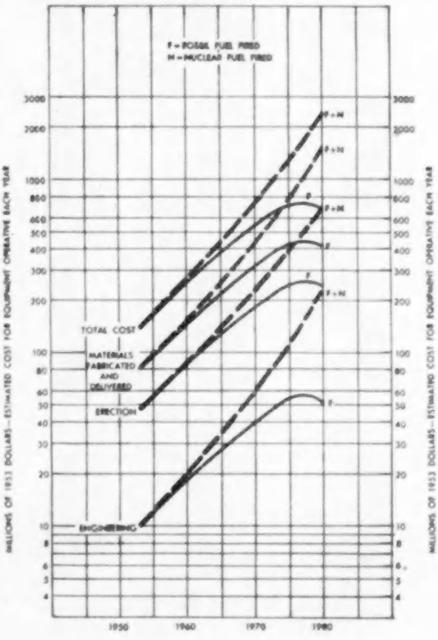
In this table are shown the values to be included in estimates of the owner's costs for services to be furnished by architect-engineers, equipment designers, and manufacturers and constructors of complete steam production plants, and the steam generating units, respectively, for fossil and nuclear fuel fired steam-electric stations for plants becoming operative in the years shown, Fig. 2 suggests the order of magnitude of the costs included for accomplishing the engineering, design development, and designing tasks by suppliers of steam generating units. These estimates provide a rough basis for forecasting nationally the dimensions of the organisations and facilities required for engineering, manufacturing, and erecting the steam generators which might be required. Table 2 indicates that the costs of the several tasks per KW are significantly higher for nuclear than for fossil fuel fired units.

The ratio of anticipated engineering costs for nuclear plants to those now customary for conventional fuel plants might, in the beginning, exceed 7½ to 1. The ratio might decrease gradually to about 3½ to 1 by 1980. The corresponding fabrication cost ratios might be expected to decrease during the same period from about 5 to about 3, and the construction cost ratios from about 3½ to 2. These ratios suggest the relative manpower requirements for contracts for equal steam plant capability additions.

Based on the forecasts, the number of nuclear power units expected to be contracted for yearly will at first be small, and the number of companies competing for them, large. Nevertheless, the longer range prospects appear sufficiently good to warrant appropriate investment for staff and facilities to anticipate the gradually increasing re-

Figure 2

OWNERS' COST
FUEL BURNING AND
STEAM GENERATING EQUIPMENT



quirements for nuclear power equipment expected.

The staff must be able to develop practical and economical designs, prepare proposals, estimates and bids, and to undertake contracts for acceptable reactor steam generating systems of advanced design, as well as for equipment and plants for other phases of the atomic energy programme, such as fuel production facilities, fuel re-processing units, research reactors, package power units, marine and naval power units.

For some years our varied activities in the atomic energy programme required us to clear for, and assign, a significant number of our personnel to projects associated with the programme. These projects, within the limitations imposed by security requirements, were at first handled by our regular departments, and many members of our regular staff acquired specialised knowledge and experience in the design and fabrication of nuclear systems and components. Appropriate selections from these sources provided key personnel for the Nuclear Energy Department which was established early in 1954 to combine and integrate into one department, under a single responsibility, all activities serving the Nuclear Energy Programme.

A New Nuclear Power Plant*

by ROBERT GOULD, Manager, Nuclear Power Project of The Foster Wheeler Corporation

FOSTER Wheeler Corporation has announced to the utility industry that it is ready to design and build, for completion by 1960-61, the first large-scale nuclear power plant utilising the aqueous homogeneous power breeder system. Such a plant, with an electrical capability of 100,000 KW, has been offered to the industry at an estimated cost to the owner of $21,000,000—a price within range of some conventional power station costs. With this type of plant, electric production costs will depend, as usual, upon such factors as system load characteristics, plant location, and method of financing. However, electricity costs could be as low as six to nine mills per KWH.† (Based on published AEC estimates, seven mill electricity would be competitive with 16 per cent of the present market.)

Foster Wheeler's varied experience in the nuclear energy programme, as well as detailed technical studies and cost estimates undertaken in connection with 28 different reactor systems, led to the decision to design and construct complete plants utilising the homogeneous reactor principle now.

Design work for the aqueous homogeneous power breeder is based on successful operating experience of the AEC at Oak Ridge with a homogeneous reactor experiment which has clearly demonstrated the essential simplicity, operability and controllability of a homogeneous reactor.

The homogeneous power breeder has been recognised as one of the two reactor systems which hold the most promise of eventually competing with conventional power systems. However, it was thought the system might not be feasible for many years to come. For this reason, the Atomic Energy Commission, in its 16th semi-annual report to Congress on 30 July, 1954, favoured both the homogeneous and the fast-breeder reactors as 'long-term' possibilities. In the AEC's time formula, this meant ready-for-testing at some indefinite time beyond five years from that date. According to the same formula, 'short-term' meant ready-for-testing in two to three years, and 'middle-term' ready in about five years. These latter evaluations were applied by the AEC to the pressurised water and sodium graphite reactors in the first instance, and to the boiling water reactor in the second.

The aqueous homogeneous power breeder system has many inherent advantages. It uses a liquid fuel, and is self-controlling to the extent that, as demand on the steam generators increases, the reactor responds by releasing the heat required. Specifically, this is accomplished through contraction of the fuel, which tends to increase the amount

* *Previously published in 'Heat Engineering', May-June 1955. Reprinted by courtesy of The Foster Wheeler Corporation.*

† *1 mill.* = $ $^{1}/_{1000}$

of uranium in the core. Additional regulation is provided by controlling the concentration of uranium in the fuel solution.

An important feature is safety. The amount of fuel in the aqueous homogeneous core system is always consistent with the amount required for operation, because it can be added continually to the system to replace the fuel that is burned. To guard against hazards due to leakage, every piece of equipment containing radioactve material is enclosed in a separate secondary vessel that will contain any leak.

Simplicity & Accessibility

Simplicity of operation and accessibility of the equipment are unique features of the plant. Although designed for minimum maintenance, every piece of equipment is readily accessible for maintenance or repairs without excessive radiation hazard.

Steam produced by the reactor system can be used to run a conventional turbo-generator.

The system essentially utilises a spherical core containing a solution of uranyl sulphate in heavy water in which the fission of Uranium 235 generates the heat required. The fuel solution is pumped through the core to steam generator heat exchangers in which saturated steam at 600 psi. is produced by the heat the fuel solution gives up. The dimensions of the core vessel are such that the fuel solution becomes critical as it circulates through the vessel.

In order that the equipment be practical, and of manageable size, four heat exchangers are used; this also permits any of the heat exchangers to be isolated for servicing when necessary.

Four canned rotor pumps are used to circulate the fuel through the core and through the heat exchangers. The core is connected to a system of non-critical dump and storage tanks. The solution may be drained out of the reactor system into these tanks, when desired, for shut-down and maintenance. This dumping arrangement is controlled by a hydraulic pressure balanced system to eliminate large valves. A separate vessel connected into the highest point in the system serves as a pressuriser and surge tank. The desired operating pressure of the system is maintained by electrical heaters in the pressuriser.

Breeding is accomplished in a blanket of fertile material contained in a spherical vessel surrounding the core vessel. The fertile material will be Thorium 232, which is converted to Uranium 233 in the breeder blanket. The uranium is used to refuel the reactor. The thorium in the breeder blanket, in heavy water, is pumped through the blanket vessel. Approximately 17 per cent of the total reactor heat output is generated in the blanket. Two heat exchangers are used to extract the heat from the blanket material and to generate additional steam at 600 psi. Two canned rotor pumps circulate this material through the blanket and through the heat exchangers. The blanket circuit is connected to a dump tank similar to that used for the core. The pressuriser in the core circuit is also connected to the blanket circuit to maintain essentially equal pressures in both circuits.

A re-processing system for the core material is included in the plant, to remove the majority of the gaseous and insoluble fission product poisons as they are being formed in the fission process. The blanket material is periodically removed for re-processing in an existing Government facility, such as the one designed by Foster Wheeler and installed at Arco.

It is anticipated that when reactors of this type are operating it will prove feasible to have a centrally located commercial re-processing plant for the blanket material to serve ten reactors.

Foster Wheeler currently has a contract to design and manufacture two of the four steam generating units to be installed in the 60,000 KW nuclear power station of the Duquense Light Company at Shippingport, Pennsylvania. This contract augments a series of nuclear projects completed by Foster Wheeler since the inception of the Atomic Energy programme, which includes the steam generators for the *USS Nautilus* and its land-based prototype at Arco, Idaho; several unusually large stainless steel heat exchangers for use in the production of nuclear materials, and design of a fuel re-processing plant at Arco which has been operating successfully for several years.

First Czech Atomic Power Plant

Dr. Frantisek Vlasak, Czechoslovakian Minister of Power, announced in Prague on 16 September that the country's first industrial atomic power station will be in operation by 1960.

Vessel Heating

Advantages of Isopad System

CONTROLLED heating of vessels up to 2,000 gallons capacity is possible using the Isomantle electric surface heating technique.

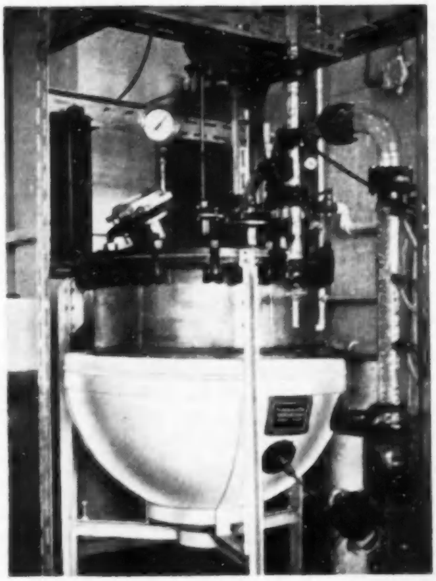
The heating surface of the Isomantle consists of Isopad weave glass cloth, which is suitable for temperatures up to 550° C and is resistant to most chemicals. The heating elements are fitted to the glass cloth surface, provided with high temperature electric insulation and backed with three to four inches of glass wool to give over 95 per cent heat transfer efficiency.

The whole surface of the vessel can be heated in this way, thus providing a high total kilowatt load although the power per sq. ft. is only of the order of 300 to 700 watts average. This is an important feature where heat sensitive chemicals are concerned as local overheating can be avoided.

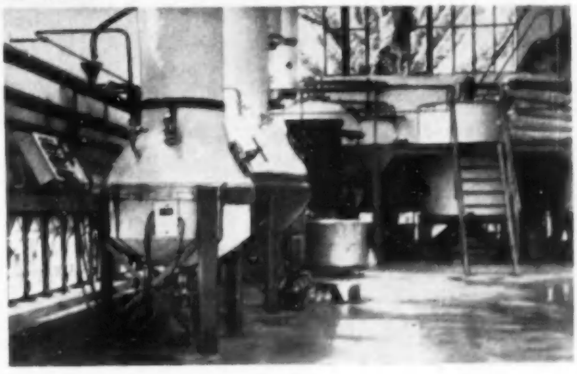
One advantage of this method of heating is that the heating surface is subdivided into a number of horizontal zones which can be independently controlled. This allows full heat input to be applied to the part of the vessel containing liquid, while the remainder can be regulated to compensate for heat losses only. Thermal stresses are avoided in this way.

Type FPM Isomantles are fitted with flameproof glands and terminal boxes and can be used in flameproof areas. The element sheath is earthed so that no sparking or short circuit is possible even if spillage occurs. Some of these units, say the company, have been running successfully for many years without maintenance and carry a three year guarantee.

In addition to the normal Isomantle, Isopad also supply Isotopmantles which are flexible electric heating mantles covering the top of the vessel.



Left: Isomantle for flameproof areas, FMP/5/25G with stainless-steel vessel at Allen & Hanburys Ltd., Ware. Support type A.



On the right is an Isomantle type IMM/5/55G on 250 litre vessel at Antoine Chiris, S.A. Grasse, South of France. Support type B.

Architectural Symmetry

PLANT construction combined with architectural symmetry is a speciality of Proabd (England) Ltd., chemical engineers, of London. The firm recently completed a high-efficiency tar distillation plant at the Plymouth Tar Distilleries Ltd.'s Plymouth works and to blend the plant with the background, when viewed from the town, bricks were specially selected.

Fired by Coke-Breeze

The company has since begun work on a similar plant for the chemical section of the Scottish Gas Board in Glasgow. This plant will be equipped with a John Thompson Triumph stoker and will be fired by coke-breeze. Although similar in design to the Plymouth plant it will differ externally as each Proabd plant is constructed to blend with its background location.

The Plymouth distillation plant now in operation is designed to produce either a 75° K & S medium soft pitch from 150 tons of crude tar per day, or road tar up to 180 tons per day at a lower pipe-still temperature. The crude tar is first dehydrated after heating in an economiser section of the pipe-still, and its temperature further raised in the main section of the pipe-still until the light fractions can be flashed off. Superheated steam injection is employed to reduce the vapour pressures, and a high degree of fractionation of the vapours is obtained in the fractionating column where the valuable by-products are recovered.

Norwood Technical College

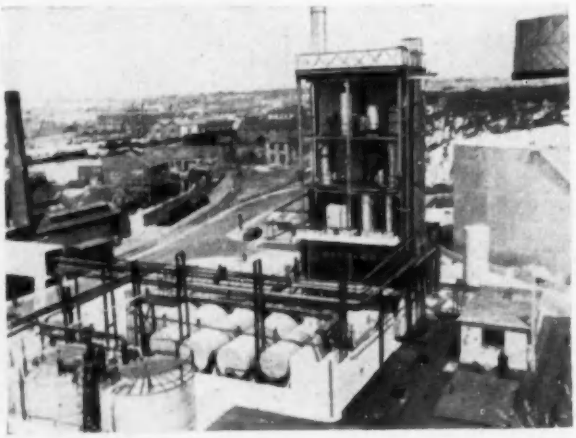
A COURSE of 12 lectures and practical work on micro and semi-micro techniques in chemistry will begin at Norwood Technical College, London S.E.27, on Saturday, 14 January. Designed to survey the principal branches of chemistry in which small-scale methods have successfully been applied, it is particularly suitable for teachers, industrial and research chemists.

All lectures will be on Saturdays from 9.15 a.m. to 12.30 p.m., and some lectures illustrated by demonstrations will deal with: scope, aim and achievements of small-scale techniques, simple chemical microscopy and photomicrography, inorganic qualitative analysis, volumetric and gravimetric analysis on a reduced scale, organic qualitative and quantitative analysis, chromatography, and physiochemical methods of analysis.

Fee for the course to London residents is £1, and £8 5s. to others unless they reside in the areas of education of the following authorities: Bucks, Croydon, East Ham, East Sussex, Essex, Hastings, Kent, and Southend or are working in the London County Council area, Brighton, the City of Canterbury or Surrey.

More Salt for Australia

Broken Hill Pty. Co. Ltd. has announced a decision to construct new evaporating ponds near Whyalla to increase the production of solar salt from sea water to 30,000 tons a year. Present production is about 5,000 tons annually.



The tar distillation plant built at the Plymouth Tar Distilleries Ltd.'s Plymouth Works by Proabd (England) Ltd. Special bricks and architectural design have combined to make the plant blend with the background of cliffs

Chromium Deposits on Aluminium

New Factory for Fescol Process

A FACTORY, specially built by Fescol Ltd. for the electro-deposition of metals was opened on 13 September at Huddersfield, Yorkshire. There the company will operate the Fescol process of applying certain non-ferrous metals—particularly nickel and chromium—to already fabricated metal components, so that the superimposed material becomes an integral part of the component. The process was initially employed to make good such deficiencies as might be caused by wear and tear or by faulty machining. New components having a comparatively cheap and easily worked base can often be improved by Fescolising.

One of the major problems formerly encountered in the production of electro-deposits for engineering purposes was to obtain adequate adhesion on light alloys, but after intensive research Fescol Ltd. solved the problem by evolving a process which enabled the chromium to be deposited on a limited range of light alloys. Experimental work was undertaken for one of the major aircraft companies, and a special plant was installed in 1951, in the former Huddersfield works, to carry out this work.

After further investigation an improved process was developed which enables the company to deposit chromium direct on to all known light alloys so that the deposited metal becomes an integral part of the base metal. The new process has received Ministry of Supply approval for use on aluminium and aluminium alloys used in the construction of aircraft and aircraft equipment. The way the Fescol process differs from many other known commercial methods is that the chromium is deposited directly on to the light alloy and does not rely on an undercoat of a second metal to ensure adhesion.

The chromium depositing shop has six vats installed in pits to give working height enabling it to deal with shafts up to eight feet in length. Power is supplied by an independent oil-immersed Westalite rectifier set.

Fuel Efficiency Exhibition

Babcock & Wilcox will be exhibiting on stands 18 and 28 at the Fuel Efficiency Exhibition in conjunction with their associated companies, Edwin Danks & Co. (Oldbury) Ltd. and Spencer-Bonecourt-Clarkson Ltd.

The display by Babcock & Wilcox will emphasise the importance of proper selection, location and use of soot blowers, etc., in obtaining maximum boiler efficiency and availability. New items on show will be a working demonstration of the Babcock shot-cleaning system and the pneumatic operation of soot blowers.

The Steambloc packaged boiler, to be shown by Spencer-Bonecourt-Clarkson, is manufactured in capacities ranging from 1,500 lb. per hour to 18,000 lb. per hour.

Interior view of the new Huddersfield factory of Fescol Ltd., showing (left) the chromium deposition tanks, the control block (centre) and (background) the nickel deposition tanks

Expanding Chemical Research

THE growth of chemical research at Battelle Institute, Columbus, Ohio, has been marked by the completion of a new $1,400,000 chemistry building. According to Dr. E. E. McSweeney, manager of the department of chemistry, seven of the nine divisions of the department, as well as one of the Institute's chemical engineering divisions, are housed in the new building, which has 98,000 sq. ft.

The building, which makes about 50 per cent more laboratory space available for chemical research, will afford room for continued growth. Special features include constant-temperature-humidity rooms, and an explosion-proof area for polymerisation studies on highly combustible materials such as butadiene.

In addition to laboratories for organic, inorganic, analytical, and physical chemical research, facilities are provided for plastics, rubber, coatings, paper, leather, and lubricant technologies.

Fuel Efficiency Exhibition

AT THE Fuel Efficiency Exhibition, to be held at City Hall, Deansgate, Manchester, 12-22 October, several companies will be exhibiting on stands Y1 and 2.

The International Combustion Organisation will be displaying exhibits showing the activities of the company in the field of combustion and steam generation.

Also on show will be working displays of Vacseal pumps and a working model of a Lopulco mill.

A central feature of the Neckar Water Company's exhibits will be the Monobed de-ionisation unit which, it is claimed, will produce from tap water a water superior in quality to ordinary distilled water. The unit will deal with 75,000 grains of total dissolved solids between regenerations. It is equipped with an automatic conductivity indicator and a Neckar automatic hardness detector.

Sulphuric Acid Plant

FURTHER sulphuric acid plant incorporating their well-known water cooled chambers, with certain improved features, have been erected recently by Mills Packard Construction Co. Ltd. of Ipswich. Apart from their usual varied activities in chemical plant construction the firm have supplied and erected steel and lead equipment for the new anhydrite sulphuric acid plant recently put into operation at Whitehaven. They were also responsible for the designing and construction of a complete self-contained dilution plant with full electrical control and recording instrumentation for Fisons Ltd. to deal with their acid from the USAC Widnes anhydrite plant.

By kind permission of Fisons, Ltd.]

Acid dilution plant by Mills Packard

Titanium To-day

Properties & Uses of a Versatile Material

ALTHOUGH titanium is the fourth most abundant metal in the earth's crust, being fifty times more common than copper or zinc, it is only recently that it has attained any commercial importance. Until the invention of the Kroll process in 1940 (reduction of titanium chloride with magnesium) no convenient method of extraction was known. It was another eight years before manufacturing techniques were established in the United States, and supplies on a commercial scale have only been available for about three years.

At the present time I.C.I. is the only industrial concern extracting the metal on a commercial scale in this country. At the end of 1954 a pilot plant was producing at the rate of 150 tons per year. A larger plant to produce 1,500 tons per year came into operation earlier this year.

The general chemicals division of I.C.I. produce the metal, using the sodium reduction method, and melting and fabrication into wrought forms such as sheet, strip, bar, tube and wire, is undertaken by the metals division.

When compared with other metals titanium shows many desirable properties. Its density is 0.56 that of steel and its ultimate tensile strength can be raised to 70-85 tons per sq. in. In many applications its corrosion resistance is better than that of stainless steel.

Film Keeps Metal Inert

At ordinary temperatures titanium is covered by a protective film which keeps it inert. This film dissolves at high temperatures, so that the metal loses its passivity and reacts rapidly with all known refractories. Small quantities of oxygen or nitrogen introduced during extraction or melting will render the metal brittle, making it commercially useless. The present high cost of the metal is said to be largely due to the need for preventing contamination and the expense of processing either in a high vacuum or in an inert atmosphere.

The strength of titanium decreases with temperature and its effective limit is thought to be not higher than 500° C. I.C.I. believe that the progressive deterioration by oxidation above this temperature may be overcome as improved alloys are developed.

Titanium is finding extensive use in the aircraft industry for gas turbine compressor blades and discs, engine cowlings and exhaust shrouds where moderately high temperatures are met. Other uses include muzzle blast tubes and the leading edges of wings where erosive conditions are encountered. As the speed of aircraft increases and heating of the skin by air friction becomes more severe, titanium may be used in greater quantities in aircraft construction.

Many Possibilities

For the chemical engineer titanium would appear to have many possibilities. It is already used in chemical plant where high strengths at moderate temperatures are required under corrosive conditions. Interest has also been shown in the possibilities of using titanium in plant intended to run at high rotational speeds; its high strength/weight ratio would lead to a reduction of centrifugal stress. Where high tensile steel cannot be used because of its magnetic properties titanium would provide a suitable substitute it is claimed.

In a handbook 'Wrought Titanium' I.C.I. have published, for the guidance of users and potential users, some facts and figures about the various grades of titanium and titanium alloys that they manufacture. This volume is necessarily incomplete they say and further editions are contemplated as more information becomes available.

High purity titanium is a ductile metal and an examination of the crystal structure provides an explanation of this. Below 882° C it has a close packed hexagonal structure known as the α phase. This phase has a c/a ratio of 1.587, considerably lower than for other hexagonal metals, which results in an increased number of slip planes being available for deformation. Above 882° C titanium has a body centred cubic structure known as the β phase. With many alloys a phase transformation of this nature can be used to obtain a moderate increase in strength at the expense of ductility. So far, however, the heat treatment

response has not been so great as with steels.

From the point of view of the chemist one of titanium's most important properties is its resistance to corrosion. This is normally ascribed to the formation of a chemically stable and protective oxide film. Its corrosion resistance in many environments is said to be superior to that of stainless steel.

Of particular importance is titanium's resistance to sea water and marine atmospheres. Its behaviour is comparable with the platinum metals. Fatigue properties show no deterioration on immersion and there is no evidence of stress corrosion.

Such varied substances as acetic acid, nitric acid, aqua regia, wet chlorine gas, and hot solutions of ferric and zinc chlorides all have little effect on titanium. It is, however, attacked by hydrofluoric, phosphoric and formic acids, and by certain concentrations of sulphuric and hydrochloric acids. A violent explosion has been known to occur when red fuming nitric acid is added to titanium.

Other important properties of titanium are that it is non-toxic and is unaffected by body fluids and by most foods and food products.

Looking ahead, I.C.I. say that they have an extensive programme of investigation into alloys designed to meet arduous requirements. A wide range of properties is available according to the grade of raw material used, and the experience of users is often necessary to decide the optimum combination of strength and ductility.

Water Cooling Units

Continuous Closed-Circuit System

IN many parts of the country it is becoming increasingly difficult to obtain adequate supplies of chemically-suitable water for cooling industrial plant and this has led Philips Electrical Limited to introduce a complete range of closed-circuit water cooling systems.

Water is continuously pump-circulated and there are only evaporation losses to replace, so that considerable reduction in water consumption is possible. Intended primarily for use with Philips high-frequency generators, the equipment is equally suited to many other cooling requirements.

Systems operate from storage tanks with capacities varying from 25-300 gallons (according to requirements) and with radiator dissipation ranging from 3-240 KW. Air cooling is provided by a motor-driven fan. Units are available in skeleton form—with the radiator, fan, pump and motors mounted on rubber bases upon a mild-steel framework—or as completely self-contained units with storage tank and all associated equipment built into a cabinet.

The tank can contain mains water if suitable, chemically-treated local water, or distilled water. It is fitted with a visual gauge, float switch, thermostat and pressure switch. A by-pass cock and pressure gauge are fitted for adjusting flow and pressure to the requirements of any particular generator.

The 80 KW unit is typical of the complete range. Capable of handling up to 1,300 gallons per hour at a maximum pressure of 55 lb. per sq. in., it can dissipate 80 KW at a maximum outgoing temperature of 35° C and maximum ambient temperature of 25° C.

New Metal Melting Process

RECENT tests carried out at the Bureau of Mines Electrometallurgical Experiment Station, in Albany, Oregon, have proved the desirability of maintaining low pressure within a furnace used for consumable electrode arc melting, the relatively new process used to produce titanium ingots.

The process consists of bringing together inside a furnace with an inert atmosphere such as helium or argon, a cylindrical electrode of the metal to be melted and a small quantity of the same metal in a water-cooled vessel, called a cup, at the bottom of the furnace. An electric current is passed through and the electrode melts the metal in the cup and at the bottom of the electrode itself. As the loss of the molten metal dropping into the pool in the cup shortens the electrode, it is moved downward automatically to maintain the necessary arc.

The Bureau's report is based on observations during the production of 45 zirconium ingots under varying conditions, and concludes that operating a furnace at reduced pressure during consumable electrode arc melting promotes electrical efficiency, ingot quality, high metal yield, and arc stability, although it points out that several phases of the process merit further study.

Liquid Heat Plant

Rapid Heating or Cooling For Resin Kettles

DURING the past year an interesting liquid heat plant has been operating satisfactorily at the works of Docker Brothers, Birmingham. This plant, designed and installed by Hygrotherm Engineering Ltd. of London, provides indirect heating to two 625-gallon and one 200-gallon kettles incorporated in a resin plant designed and installed by L. A. Mitchell Ltd. of Manchester.

The Hygrotherm plant comprises two 1,000,000 B.Th.U./hr. liquid heat generators of the firm's own special design, fired with Laidlaw Drew modulating flame oil burners controlled by a pneumatic recorder controller, which maintains a constant temperature in a ring main. The ring main temperature can be set at anything up to 340° C and this temperature is maintained under fully automatic control during the whole time the plant is in operation.

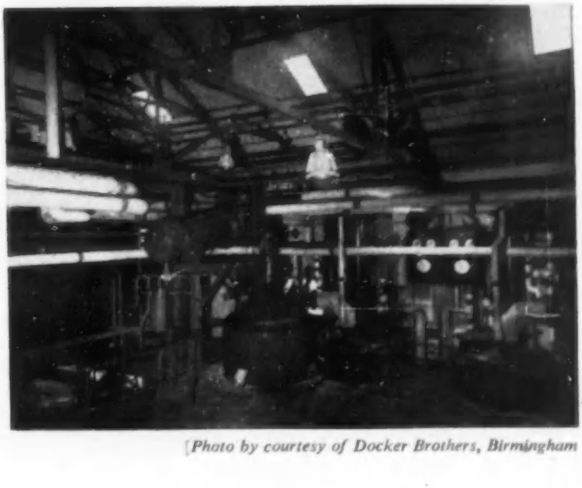
Each of the vessels is fitted with a baffled jacket through which tetra-aryl silicate is circulated by means of a pump, one pump being provided for each vessel. On the control platform are situated three valves, by manipulation of which the operator can provide heating, recirculation or cooling, according to the requirements of the plant.

The temperature at which the liquid is circulated through the jacket and the temperature of the batch are shown on temperature recorders adjacent to the valves, so the operator is in full control of the heating or cooling for each batch and can adjust it to his wishes.

The interesting feature of this plant is the speed with which a large batch in the kettle can be brought up to temperature, and particularly the rapidity with which the temperature may be lowered at the completion of the process, thus arresting further polymerisation and ensuring a batch in the exact condition required. The heating up and cooling down times depend largely on the type of resin being made and it is possible to heat up a full batch in anything from 1½-hours to 4 hours as desired, and it may be cooled down to a temperature of 200° C in 15-20 minutes.

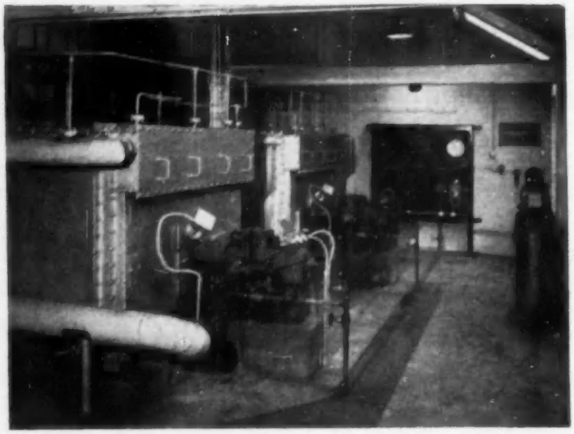
This is possible due to the correct thermal design of the plant and making use of the wide operating range of tetra-aryl silicate 180. The use of an aryl silicate ensures not only speedy operation, but a completely liquid tight system, without having to worry about losses of liquid from flanges and valves, the only loss occurring being a very small quantity which is allowed to pass by the gland of the specially designed process heating pumps, this loss being carefully controlled by proper adjustment of the gland.

Test samples have been taken of the heat



A general view of the resin plant which operates from liquid heat

[Photo by courtesy of Docker Brothers, Birmingham



The liquid heat generators in the boiler house

Photo by courtesy of Docker Brothers, Birmingham]

transfer liquid during the past year, which show very little change in its condition with an indication that it will last for several years yet.

Supplementary to the main purpose of this plant a certain amount of liquid is taken from the ring main to heat up a rosin melting pot and also keep the phthalic lines warm, the liquid being circulated through jackets on the lines.

The plant operates without any supervision by the main boiler house other than the requirements of normal maintenance, and the operation of the plant in the varnish kitchen itself is in the hands of the plant operators, who manipulate the heating, re-circulation or cooling valves according to the requirements of the process, without having to make any direct reference to the main heat generators, which are situated in a building away from the main plant.

Editor's note: The above information was provided by Hygrotherm Engineering Ltd. by kind permission of Docker Brothers of Birmingham.

Raney Nickel Catalyst

BDH Produce Stabilised Form

THE VERSATILITY of Raney nickel catalyst in bringing about numerous reductions with hydrogen under moderate conditions of temperature and pressure is now well established. Thus, for example, olefines can be cheaply and rapidly reduced to paraffins, ketones to alcohols and nitro compounds, oximes or nitriles to amines. More recent applications include stages in the preparation of steroid hormones and the reduction of aldol to 1:3-butandiol, an intermediate for Buna rubber.

Raney nickel catalyst is prepared by the treatment of a powdered alloy of aluminium and nickel with hot sodium hydroxide solution whereby the aluminium is dissolved and the nickel left as a heavy, finely-divided powder which is stored under water or alcohol.

Since the catalytic activity tends to fall during storage, this somewhat troublesome preparation, which needs to be carefully controlled if a fully active product is to be obtained, must usually be carried out by the chemist each time the need for the catalyst arises.

Measuring the necessary quantity for any particular reduction is also tedious, and is usually achieved by a trial and error process of decantation from a graduated cylinder.

Hitherto, it has not been possible for manufacturers to supply the ready made catalyst owing to the dangers of handling (it is pyrophoric when dry) and to the impermanence of the catalytic activity under conditions which involve exposure to the air.

These difficulties have now been overcome by British Drug Houses Ltd., in a stable non-pyrophoric preparation from which the fully active catalyst can be regenerated by the simple process of washing with alcohol. The preparation takes the form of small cylinders, each containing 0.5 g. of Raney nickel, one or more of which may be used as required. It has good keeping properties.

Kestner & Wild-Barfield

Reaction, Heating & Drying Plant

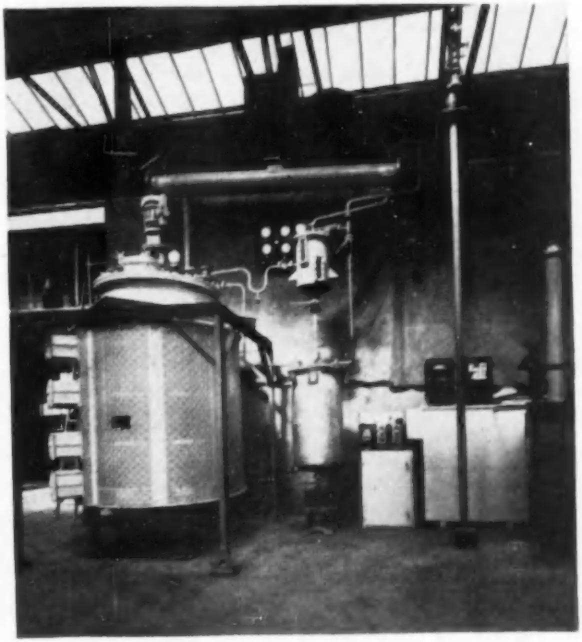
THE Kestner Wild-Barfield patent Induction Heating system is the latest of a series of electrical heating systems made available to the chemical industry and the paint trade more specifically, by the Kestner organisation, and it is claimed to be the most versatile and flexible of all, having an inherently high efficiency, being extremely robust, and requiring a minimum space for installation.

The plant illustrated in the accompanying photographs is a flameproof 750 Imperial gallons gross capacity synthetic resin plant, fitted with a horizontal water cooled condenser, of the tube and shell type and a separator/receiver with controlled reflux system. An additional receiver is fitted for draining the separator/receiver as required and is included to give additional flexibility in the type of product for which the equipment may be used.

The complete equipment is arranged to give stainless steel contact throughout, being constructed mainly in stainless steel except for the actual kettle body which is manufactured in homogeneously bonded, stainless steel clad, mild steel plate with a 20 per cent stainless steel thickness for contact surface.

The Induction Heating system itself consists of an inductor assembly which is offered up to the kettle, the kettle being co-axially mounted within it, and is equipped for operation from a 3 phase, 50 cycle electric supply direct. The input at full power is arranged to be 140 KW and additional switching circuits are arranged from standard control instruments to permit the reduction of this input to ⅓ full power, and automatic maintenance of batch temperatures by switching in and out the low power loading as required.

The inductor unit itself consists of a pair of cylinders of heat and electrical insulating material, formed from suitable sections and joined together to form a rigid assembly.



This illustration gives a general view of the complete equipment showing in detail the refluxing and receiver arrangements together with switchgear and control instruments

Patent continuous neutraliser *(see p. 678)*

The annular space between these two cylinders is filled with a suitable heat insulating material.

A pair of flat annular plates are fitted to the tip and bottom of the cylindrical body of the inductor, one in mild steel and the other in heat insulating material, these being used for protection and support. The steel annular plate is for mounting the complete assembly and to carry the necessary fixing holes or studs.

The windings are suitably arranged on the outer of the two body cylinders and are of heavily insulated high conductivity copper strip, firmly secured into their operating positions. The ends of the windings are connected by heavy duty bus-bars into flameproof terminal boxes of approved design.

The windings are additionally protected by means of a perforated mild steel cover mounted between the two annular flanges and spaced well clear of the conductors. This cover is suitably finished with a protective coat of paint.

This structure is self-supporting and designed to be mounted from its top support ring, and may be suitably strengthened if necessary so that the vessel can be supported by it, thus only one set of support framework is required.

A special finish is applied to the outside wall of the kettle which is intended to improve the power factor of the completed equipment to a very high degree, and also to permit the use of an external cooling water jacket on the kettle. The external water jacket, it has been proved in other types of plant, is a very desirable feature to assist in rapid cooling of the charge and while practical with Kestner Wild-Barfield equipment, cannot be applied to general forms of induction heating.

The control instruments are of conventional pattern while the switchgear is specifically designed in each case for the required duty and sequence switching of the installation, being fitted with rolling butt contactors with sintered contacts which are completely interlocked with the isolating switch, to prevent the opening of the contactor panel while power is switched on.

Dry Products

Demand for dry powdered and granular products in the food, chemical and allied industries has increased in recent years through economic pressure in that dry products have longer storage life, are cheaper to transport, and require less expensive packing. To meet this need Kestner Evaporating & Engineering Co. Ltd. have developed several types of drying plant, and one of them, the TV Pneumatic Drier for starch drying was designed in co-operation with the Home Office in order that a drier design could be developed to fulfil safety requirements as starch is a Class 1 explosion hazard. Two types of the drier have been marketed, one for the manufacturer who requires to reduce the moisture content of starch from about 40 to 12 per cent, and for the consumer requiring that the starch be dried from 12 to four per cent.

Pneumatic Driers

Pneumatic driers have been used in certain limited fields for some time. Previously they consisted of a long vertical parallel tube into the bottom of which hot air was blown and the material to be dried was introduced into the air stream within a foot or two of the bottom of the tube.

For a variety of reasons this design is not satisfactory and after a series of tests the Kestner Company introduced an entirely new shape of drying column. This, the Thermo-Venturi or TV tube, first converges to the feed point, then diverges in a gentle

[*continued on page 678*

Kestner & Wild-Barfield

continued from page 676

taper to a parallel section and finally converges again at the top.

The hot air for drying can be obtained from any convenient source and the method of collecting the dried particles can be selected to suit individual requirements.

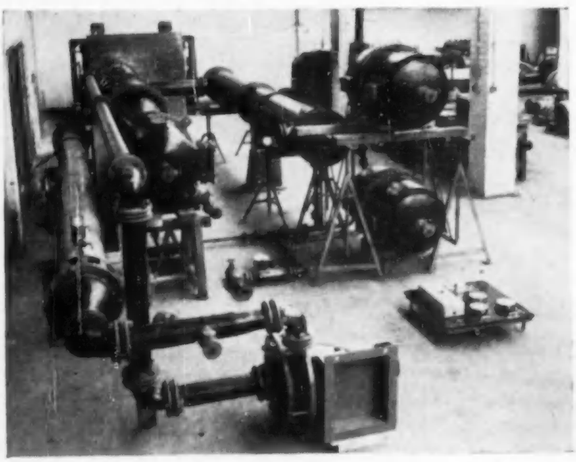
New in the range of Kestner equipment is the patented continuous neutraliser, a reaction vessel supplied with a special baffling arrangement to ensure intimate mixing. It has a high efficiency double vortex stirrer, a dry chemical feeder and a *p*H pot to assess the degree of neutrality of the finished mixture. This apparatus has to-date been supplied mainly to steel pickling plants, plating shops and similar processes where an effluent is produced under normal conditions which may be toxic to fish or to biological organisms. The plant is constructed in the company's Keebush material, an acid-resisting plastics compound which can be worked at temperatures up to 130° C.

Another Kestner plant making full use of Keebush is the carbon tube evaporator assembly used in the manufacture of monosodium glutomate. The evaporator is installed in the complete plant to concentrate and remove common salt from acidified glutamic acid mother liquor. It is of the long-tube vertical type with forced circulation and salting type separator, and the Keebush has to withstand the action of hydrochloric acid under pressure and high temperature.

The Kestner organisation has spent considerable time on research into immersion gas heating systems and the Kestner immersion gas-fired heating system which has recently been perfected is now available. Its basic principle is that flue gases at a controlled temperature are constrained to pass at high velocity through a continuous multi-turn immersion coil fitted in the reaction vessel to be heated. The controlled temperature at the inlet is adjustable to suit the product, so giving freedom from deterioration due to overheating. The high velocity of the flue gases passing through the coils gives improved heat transfer to the charge as well as to the gases leaving the heating tube, thus eliminating the heavy use of fuel. Thermostatic control can be fitted for both total input heat requirement and for the heating gas temperature control.

By the utilisation of the same multi-turn immersion coil when cooling is required, it is arranged that cold air is drawn through the coil in place of the hot flue gases, again at high velocity and therefore high efficiency thus rendering no further apparatus for cooling necessary, and also eliminating the possibility of cooling and heating cycles coinciding, with consequent loss of efficiency.

Thermostatic control can be arranged to suit the conditions as required both for total input heat requirement and also for the heating gas temperature control, thus rendering the equipment fully automatic in operation, and also giving safe working conditions.



Carbon tube evaporator assembly on manufacturing shop floor before dispatch to clients. Apparatus forms part of complete plant shipped to Hong Kong in 1954

Edwards High Vacuum

Speedivac & Booster Vapour Pumps

ONE of the main difficulties encountered when using conventional oil immersed rotary pumps for pumping many types of vapours which are met with in the chemical industry, is contamination of pump oil and damage to the pump interior. The Speedivac range of rotary pumps has now been modified, however, so that such vapours may be handled safely. This is achieved with the aid of a device known as air ballasting which involves the controlled bleeding of air into the pump during the compression cycle so that vapours are prevented from condensing and leave the pump in vapour form.

Under normal conditions these vapours would condense and enter into the pump oil as liquids, re-enter the oil feed to evaporate on the high vacuum side and thus affect the final vacuum. This situation will grow progressively worse resulting in the complete contamination of the pump oil and damage to the pump interior. Where vapours are not being pumped the air ballast valve can be closed and the pump used in the normal manner. Even with the gas ballast valve open the ultimate vacuum obtainable with these pumps is claimed to be more than suitable for most normal requirements in the chemical field.

Backs New Booster

One of the many uses of Speedivac pumps is as a backing pump for the new booster vapour pumps which Edwards have introduced. The features of these new boosters are very high speeds at pressures immediately below one millimetre of mercury and the high backing pressure at which they will operate. The normal diffusion pump when employed for high speeds at low pressures does not reach its maximum performance until a vacuum of approximately 0.001 mm. of mercury is obtained and for the great majority of uses within the chemical industry such fine pressure is not necessary, nor would it be economical to work to such fine limits. Already these pumps have been used in numbers on vacuum furnaces, impregnation plant, de-gassing equipment and molecular distillation units, and it is hoped they will find even larger outlets where chemists have been compelied to shelve projects because of lack of suitable and economical pumping equipment in this pressure range.

Both these developments have many uses outside the chemical field. For example, booster pumps backed by air ballasted pumps, are fitted to Edward's own large vacuum coating units where, backing a normal diffusion pump, they ensure high speeds throughout the whole pumping cycle, from atmospheric down to evaporating pressure and are well equipped to handle the masses of volatile vapours given off by plastics articles under vacuum.

Paint Laboratories Opened

ON Friday, 16 September, the Rt. Hon. Malcolm McCorquodale opened the new paint technology laboratories at the Borough Polytechnic, London, S.E.1. Prior to the official opening the laboratories had been open all the week to permit visitors to inspect the equipment of the laboratories which was bought from money given by the paint and allied industries.

As the London County Council does not make grants for any specialised branches of chemistry, the Borough Polytechnic Old Students' Association approached the paint and allied industries for financial aid. The result of the appeal was that the Borough Polytechnic was enabled to spend £1,400 on equipment for its paint technology section.

Now the Borough Polytechnic are making all-out efforts to develop day-student courses in paint technology, and for the new course that started on Monday, 19 September, several Indian and Pakistani students were enrolled. Dr. Fiske, Ph.D., F.R.I.C., who joined the Borough Polytechnic in May as the first full-time instructor in paint technology told THE CHEMICAL AGE reporter that the range of new apparatus fully equipped the institution to run day-student courses. Dr. Fiske, an assistant professor in chemistry in China before the war, left an industrial post to join the Borough Polytechnic.


REQUIRED---
A packingless, self-priming centrifugal pump, for corrosive liquids, aerated solutions, and other difficult chemical applications.
Answer : LaBOUR Type G
REQUIRED---
A simple, efficient centrifugal pump, not necessarily self-priming but able to free itself of minor volumes of air or vapour, to handle various acids and caustics.
Answer : LaBOUR Type Q
REQUIRED---
A dependable, self-priming centrifugal pump at minimum cost for quality equipment, to handle acids, caustics, "dry" liquids, and liquids containing small solids or fibres.
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Chemical Engineering Standards

THE following is a sectional list of British Standards relating to chemical engineering, some of which will be of interest to industrial chemists and chemical engineers. In the case of publications marked 'out of print', a limited number of copies is held available for loan purposes and a copy may be borrowed if desired. 'Add' signifies that an addendum or corrigendum is issued with this standard. Copies are obtainable from British Standards Institution, Sales Branch, 2 Park Street, London W.1.

B.S.

CHEMICAL PLANT

186 : 1949 Cast-iron and enamelled cast iron steam-jacketed pans for the chemical and allied industries. **2/6.**

189 : 1925 Cast-iron filter plates and frames. Temporarily out of print.

470 : 1932 Manhole openings for chemical plant—fixed and mobile. Size and position only. (Not applicable for pressures over 175 lb. per sq. in.) **2/-.** *Add.* July, 1933.

767 : 1951 Hydro-extractors and centrifugal machines. **2/6.**

970 : 1955 Wrought steels in the form of bars, billets and forgings up to 6 in. ruling section, for automobile and general engineering purposes. En series. **12/6.**

974 : 1953 Symbols for use on flow diagrams of chemical and petroleum plant. **3/6.**

1500 : 1949 (Provisional) Fusion-welded pressure vessels for use in the chemical and allied industries. **25/-.** *Add.* September, 1950, and July, 1952.

1501/6: 1950 Steels for use in the chemical, petroleum and allied industries. **12/6.**

1507-8: 1950 Steel pipes and tubes, for pressure vessels **10/6.** *Add.* May, 1951.

1634 : 1950 Dimensions for stoneware pipes and pipe fittings for chemical purposes. **2/6.**

1669 : 1950 Industrial perforated plates. **2/-.**

1710 : 1951 Colour identification of pipe lines. **3/-.** *Add.* April, 1954.

1812 : 1951 Textile screening cloths. **2/-.**

1973 : 1953 Polythene tube for general purposes, including chemical and food industry uses. **4/-.**

2598 : 1955 Glass pipeline and fittings. **4/-.**

CONTAINERS, DRUMS, ETC.

678 : 1952 Carboys and carboy hampers. **3/6.** *Add.* September, 1952.

814 : 1950 Mild steel drums (light duty—fixed ends). **2/-.**

830 : 1953 80 oz. and 90 oz. Winchester bottles, **2/-.**

1133 Section 10 : 1953 Packaging code. Metal containers. **10/-.**

1702 : 1950 Mild steel drums (heavy duty—fixed ends). **2/-.**

1918 : 1953 Glass container finishes.
a. Shallow continuous thread finish.
b. Tall continuous thread finish. **2/6.**

2003 : 1953 Mild steel drums. Heavy and light duty, removable heads. **3/-.**

GAS CYLINDERS

341 : 1945 Valve fittings for compressed gas cylinders. **4/-.**

349 : 1932 Identification colours for gas cylinders. **2/-.** *Add.* March, 1938, January, 1942, January, 1947 and June, 1952.

349C: 1949 Chart for identification colours for gas cylinders. **10/6** mounted, **6/6** unmounted.

B.S.

(*Size approx.* 21 *in. by* 30 *in.*) *Add.* June, 1952.

399 : 1930 'High carbon' steel cylinders for the storage and transport of 'permanent' gases. **2/6.** *Add.* June, 1937, May, 1938, March, 1942 and February, 1954.

400 : 1931 'Low carbon' steel cylinders for the storage and transport of 'permanent' gases. **2/-.** *Add.* June, 1937, May, 1938, and March, 1942.

401 : 1931 Steel cylinders for the storage and transport of 'liquefiable' gases. **2/-.** *Add.* June, 1932, June, 1937, May, 1938 and March, 1942.

1045 : 1942 Manganese steel gas cylinders for atmospheric gases. **3/-.** *Add.* June, 1942 and September, 1945.

1287 : 1946 'High carbon' steel gas cylinders for carbon dioxide, nitrous oxide and ethylene. **2/-.**

1288 : 1946 'Manganese' steel gas cylinders for carbon dioxide, nitrous oxide and ethylene. **2/-.**

1319 : 1955 Medical gas cylinders and anaesthetic apparatus. **5/-.**

1319C: 1955 Chart for medical gas cylinders and anaesthetic apparatus. **3/-** unmounted, **6/-** mounted and varnished. (*Size* 13 *in. by* 21 *in.*)

1736 : 1951 Filling ratios for liquefiable gases. **2/-.**

GAS GENERATORS AND RETORTS

799 : 1953 Oil burning equipment. **10/-.** *Add.* June, 1954.

819 : 1938 Test code for horizontal retorts and intermittent vertical chambers. **5/-.**

859 : 1939 Fuel fired furnaces for heating and heat treatment purposes. **10/-.**

995 : 1942 Test code for gas producers. **7/6.**

999 : 1942 Test code for coke ovens. **7/6.** *Add.* May, 1944.

1034 : 1942 Test code for continuous vertical retorts, **5/-.**

1784 : 1951 Test code for carburetted water-gas plant. **7/6.** *Add.* November, 1952.

HOSE, JOINTING AND BELTING

351 : 1950 Friction surface rubber transmission belting. **2/-.** *Add.* July, 1954.

424 : 1931 Vegetable tanned leather belting. **2/6.**

490 : 1951 Rubber conveyor and elevator belting. **3/-.**

†674 : 1942 Rubber joint rings for water mains and sewers. **2/-.** *Add.* January, 1945.

†772 : 1942 Rubber joint rings for gas mains. **2/-.** *Add.* January, 1945.

†796 : 1943 Rubber hose with cotton braided reinforcement. **3/6.** *Add.* June, 1945. *Revised edition available shortly.*

†924 : 1943 Rubber hose with woven fabric reinforcement. **3/6.** *Add.* June, 1945. *Revised edition available shortly.*

†1102: 1943 Rubber suction and discharge hose with woven fabric and wire reinforcement. **3/6.** *Add.* June, 1945.

1440 : 1948 Endless V-belt drives. *Add.* January, 1951. **4/-.**

1737 : 1951 Jointing materials and compounds for water, town gas and low-pressure steam installations. **5/-.** *Add.* Aug. 1953.

1782 : 1951 Couplings for suction and delivery hose, other than fire hose couplings. **5/-.**

1906 : 1952 Hose couplings (air and water) ¼ in. to 1½ in. nominal sizes. **10/-.** *Add.* April, 1953.

2066 : 1953 Balata belting. **2/6.**

2464 : 1954 Hose couplings for petrol, oil and lubricants (¾ in. to 4 in. nominal size). **7/6.** *Add.* January, 1955.

2599 : 1955 Flax canvas unlined hose for fire-fighting

[*continued on page 684*

B.S.

METAL FINISHING

558 & 564 : 1953 Nickel anodes and salts for electroplating. **4/-.**
622 : 1953 Cyanides for electroplating. **2/6.**
1224 : 1953 Electroplated coatings of nickel and chromium. **2/6.**
1391 : 1952 Performance test for protective schemes used in the protection of light-gauge steel and wrought iron against corrosion. **5/-.** *Add.* August, 1954.
1448 : 1948 Nomenclature of decorative metallic finishes. **2/6.**
1468 : 1948 Tin salts for electroplating. **2/-.**
1561 : 1949 Silver anodes and silver salts for electroplating. **2/-.**
1615 : 1949 Anodic oxidation finishes for aluminium and aluminium alloys. **3/-.**
1706 : 1951 Electroplated coatings of cadmium and zinc on iron and steel. **2/6.** *Add.* April, 1952.
1872 : 1952 Electroplated coatings of tin. **2/6.**
2569 : 1955 Sprayed metal coatings.
Part 1. Protection of iron and steel against corrosion. **2/-.**
Part 2. Protection of iron and steel by aluminium against corrosion at temperatures between 120°C and 950°C. **2/-.**
PD.420 : 1953 Methods of protection against corrosion for light gauge steel used in building. **3/-.**
PD.539 : 1946 Recommendations for phosphate coatings as a basis for painting steel. **1/-.** *Add.* July, 1948.

TEST PROCEDURE & EQUIPMENT

410 : 1943 Test sieves. **4/-.** *Add.* October, 1943, April, 1946 and April, 1955.
784 : 1953 Methods of test for chemical stoneware. **3/-.**
1041 : 1943 Temperature measurement. **12/6.** *Add.* January, 1946.
1042 : 1943 Code for flow measurement. **15/-.** *Add.* March, 1946 and September, 1948.
1756 : 1952 Code for the sampling and analysis of flue gases. **10/6.**
1796 : 1952 Methods for the use of B.S. fine-mesh test sieves. **3/6.**

MISCELLANEOUS

138 : 1948 Portable fire extinguishers of the water type (soda acid). **2/6.** *Add.* April, 1952.
334 : 1928 Chemical lead. **5/-.**
335 : 1928 Regulus metal. **2/6.**
740 Part 1 : 1948 Portable fire extinguishers of the foam type. **2/6.** *Add.* April, 1952.
740 Part 2 : 1952 Portable fire extinguishers of the foam type (gas pressure). **6/-.**
1013 : 1946 Disinfectant and sanitary powders. **2/-.**
1135 : 1943 Spraying nozzles. **2/-.**
1382 : 1948 Portable fire extinguishers of the water type (gas pressure). **2/6.** *Add.* April, 1952, August, 1949 and December, 1954.
1647 : 1950 pH Scale. **2/-.**
1651 : 1950 Industrial safety-gloves. **4/-.** *Add.* January, 1951 and November, 1952.
1721 : 1951 Portable fire extinguishers of the carbon tetrachloride type. **4/-.** *Add.* January, 1953, June and November, 1954.
1725 : 1951 Thermodynamic properties of refrigerants. **10/6.**
1901 Part 1 : 1952 Stirrup pumps. Piston type. **2/-.**
1907 : 1954 Industrial overalls for men, youths, women and girls. **3/-.**
1991 Part 1 : 1954 Letter symbols, signs and abbreviations. Part 1 General. **6/-.**
350 : 1944 Conversion factors and tables. *Add.* April, 1949, Feb., 1952, Oct., 1953 and Jan., 1954. **10/6.** Also including Addendum No. 1 : 1949. (PD 957), available separately if required. **2/-.**

† *War Emergency Standard.*

B.S.
600 : 1935 Application of statistical methods to industrial standardisation and quality control. By Dr. E. F. Pearson. **15/-.**
600R : 1942 Quality control charts. **7/6.**
1000 — Universal decimal classification (for detailed particulars see separate list).
1219 : 1945 Printers' and authors' proof corrections **2/6.** (*Add.* April, 1950.)
1219C: 1945 Table of symbols for printers' and authors' proof corrections. **1/-.**
1313 : 1947 Fraction-Defective charts for quality control. **6/-.**
1638 : 1950 Report on the selection of ranges of types and sizes (preferred numbers). **3/-.**
2045 : 1953 Preferred numbers. **2/6.**
2564 : 1955 Control chart technique when manufacturing to a specification. **10/6.**
PD488: 1946 Memorandum on sampling clauses in specifications for manufactured articles. **1/-.**

The following lists of British Standards are available on application :—

Acoustics, Aircraft, Automobile Engineering, Building, Chemical Engineering, Chemicals, Fats, Oils, Scientific Apparatus, Cinematography and Photography, Coal, Coke and Colliery Requisites, Consumer Goods, Drawing Practice, Electrical Engineering, Farming, Dairying and allied interests, Gas and Solid Fuel, Glassware, Hospital Equipment, Illumination and Lighting Fittings, Iron and Steel, Mechanical Engineering, Nomonclature, Abbreviations, and Symbols, Non-Ferrous Metals, Packaging and Containers, Paints, Varnishes and Paint Materials, Personal Safety Equipment, Petroleum Industry, Plastics, Printing, Paper and Stationery, Road Engineering, Rubber, Shipbuilding, Textiles and Clothing, Universal Decimal Classification, Welding.

BSI Yearbook includes subject index and abstract of every British Standard issued (12s. 6d.).

Smoke Abatement Conference

THE Government's Clean Air Bill will be the principal subject for discussion at the annual conference of the National Smoke Abatement Society at Bournemouth on 28 tc 30 September. An early session will take the form of an Any Questions programme, with a panel consisting of Sir Ernest Smith (president of the Society) in the chair, the Rt. Hon. Alfred Robens, MP, and Mr. Gerald Nabarro, MP.

Over 550 registrations to date will make this the largest air pollution conference yet held. Government departments, technical institutions, the national fuel and power industries, private firms, and individual members will be represented, but the majority of delegates will be from local authorities.

The Des Voeux Memorial Lecture this year will be by Dr. A. Parker, Director of Fuel Research, Department of Scientific & Industrial Research. His subject will be 'The Destructive Effects of Air Pollution on Materials', a comprehensive review of the damage done to stone and other building materials, iron and steel and other metals, leather, paper and textiles, by the pollution from industry and home.

· HOME ·

Change of Address

From 24 September Shell Chemical Co. Ltd.'s divisional sales office in Manchester will be at 144/146 Deansgate, Manchester 3. Telephone: Deansgate 6451.

Carriage of Dangerous Goods

The 14th list of amendments to Appendix A of the 1951 Report of the Departmental Committee on the Carriage of Dangerous Goods & Explosives in Ships may now be obtained from HM Stationery Office, price 4d.

75th SCI Annual General Meeting

The 75th annual general meeting of The Society of Chemical Industry will be held in London next year, probably the second week in July.

United Steel Moves

From 24 September, the Manchester office of The United Steel Companies Ltd. will be at National Building, St. Mary's Parsonage, Manchester 3. Telephone: Blackfriars 3526.

Gas from Oil at Dundee Plant

The Scottish Gas Board is to erect its first catalytic oil gasification plant at Dundee which will produce gas from oil to supplement existing coal gas sources. The final plans are in process of completion, Mr. W. S. Johnson, Dundee group manager Scottish Gas Board, told the Dundee Rotary Club, and would be finalised within the next few months. It is hoped to have the plant operating within the next two years and to secure a daily output in the region of 3,000,000 cu. ft.

Revolving Fund for Industry

The Board of Trade have accepted a recommendation from the independent advisory committee that all Revolving Fund loans offered after 17 September, 1955, shall until further notice bear interest at five per cent per annum, subject to any exceptions which the committee may consider desirable in particular cases. The Fund is available to assist projects intended to improve productive efficiency in small and medium sized manufacturing concerns. Details of the Fund are contained in a leaflet which may be obtained from the Board of Trade Press Office, Room 2150, Horse Guards Avenue, London S.W.1, and from regional offices.

London Office

Next Monday, 26 September, The Geigy Co. Ltd., of Manchester, move into new London offices at 42 Berkeley Square, W.1; Telephone: HYDe Park 9416.

Society of Leather Trades Chemists

The 50th meeting of the Manchester Group of the Society of Leather Trades Chemists will be held on Saturday, 29 October, at 2.30 p.m., in the College of Technology, Manchester, when Dr. T. Vickerstaff will give a lecture on 'Colours and How We See Them'.

To Attend Copenhagen Fair

Mr. J. G. Window, sales director of QVF Ltd., is leaving for a Scandinavian trip on 27 September. In Oslo he will see the firm's agents, E. D. Knutsen & Co., and will later visit Stockholm for simliar talks before going to Copenhagen for the British Trade Fair where he will be in attendance on the QVF stand.

British Oxygen's Belfast Factory

The factory for the production of industrial and medical gases being built in Castlereagh, Belfast, by the British Oxygen Co. Ltd., is nearing completion. The existing factory in Musgrave Channel Road will eventually be closed down and the staff transferred to the new works. The factory will include plant for the production of liquid oxygen, compressed oxygen and dissolved acetylene. Medical oxygen will also be compressed into cylinders and there will be a plant for nitrous oxide production.

First Sterling Brand Price List

Albright & Wilson Ltd. have just issued a 53-page booklet containing the prices of Sterling brand chemicals. This is the first price list issued by the fine chemicals division, which was formerly Thomas Tyrer & Co. Ltd.

No Gas Price Concessions for Ceramics

The West Midlands Gas Board has refused to grant price concessions to the ceramic industry. This was announced at a meeting of the Consultative Council in Birmingham when it was reported a memorandum had been received from the Pottery Manufacturers' Federation on the effect of increased gas prices.

· OVERSEAS ·

Denver Firm Wins Design Contract

The Stearns-Roger manufacturing company of Denver, Colorado, have won the $240,000 design contract for the new Bureau of Mines helium plant to be built at Exell, Texas.

Potash Loan

Talks concerning the pre-war German potash loan have now reached their final phase, it is learned in Bonn. It is hoped that a full meeting of bondholders will be convened during the second half of October. Servicing of the loan is expected to be resumed by the end of this year.

Lever Brothers SA

A new £1,500,000 factory for Lever Brothers (South Africa), at Boksburg in the Transvaal, will be opened on 13 October by the Minister of Economic Affairs, Dr. Van Rhijn.

US Atomic Equipment

The United States Atomic Energy Commission has released from export controls from 26 September some instruments and equipment used in atomic energy work. The items include radiation detection instruments, mass spectrometers, large vacuum diffusion pumps and types of electro-nuclear machines. The Commerce Department will apply its own export controls to most of them.

Uranium Experts

At Canberra on 8 September the Australian Minister of Supply, Mr. Beale, told the House of Representatives that Britain is negotiating to buy the output of two Australian uranium fields. British experts, he said, would soon be arriving in Australia to assess the fields in Queensland and in the Northern Territory.

Copper in Israel

The Machzavei Israel (Israel Mines) Co. have started work on a copper plant at Timna, near Eilat, Israel. The plant will be equipped to process 1,500 tons of ore daily, and should yield up to 6,750 tons of metallic copper annually. In its first stage of operation the plant will produce copper-cement containing 75-80 per cent metallic copper; later it will shift to the production of black copper (blister) containing 99 per cent metallic copper.

US Oil Companies Warned

The Director of Defence Mobilisation, Mr. Fleming, has warned 18 US oil companies that the Government will cut their oil imports unless they do them voluntarily. US crude oil imports in the first seven months of this year had increased by 15 per cent, while domestic production had increased by only 5 per cent.

German Chemical Exports

More than 61 per cent of West German chemical exports last year, valued at DM.2,980,000,000, went to European countries, compared with 59.5 per cent in the previous year. Outside Europe exports dropped from 40.5 per cent to 38 per cent, especially in North and Central America. The US cut its imports from West Germany by about one-third.

Italian Sulphur Exports

In an attempt to revive the export of sulphur from Italy, the Italian Sulphur Organisation has announced that the Council of Corporation (a government-controlled body directing the production, sale and export of sulphur) has decided to grant a rebate of Lire 11,000 ($17.46) per ton on every ton of sulphur produced and exported. Exports during the first three months of 1955 amounted to only 50 tons, compared with 624 tons during the similar period last year. It is hoped that with added incentive the industry, which has been in the throes of a depression, may be stimulated.

Rosin Plant Contract

G and A Laboratories, Inc., of Savannah, Georgia, manufacturers of Galex (dehydroabietic acid, a nonoxidising rosin), has signed a contract with Battelle Institute, Columbus, Ohio, for engineering services in connection with the design, construction, start-up, and operation of a plant to be located at the site of G and A's present Savannah operations. The proposed plant will be designed for continuous operation and will have a capacity of 2,500 lb. per hour of Galex stabilised rosin pellets using a pelletising process developed at Battelle for G and A. The contract with Battelle is expected to continue for about 10 months with plant operations estimated to commence early in January.

· PERSONAL ·

MR. A. M. ROBERTSON has been appointed general manager of Scottish Oils & Shell-Mex in succession to MR. T. W. LYLE who retires on 30 September.

MR. D. D. MATHIESON succeeds MR. J. E. BARNARD, retired, as director of Gas Purification & Chemical.

Because of ill-health, MR. KEN HAVEN has resigned his directorship with Reichhold Chemicals Inc., US. He is succeeded by DR. STEFAN H. BAUM.

MR. PATRICK MOXEY, assistant editor of the Iliffe technical monthly *British Plastics*, has joined Bakelite Ltd. as press officer. Mr. Moxey, who is 30, has had considerable works and laboratory experience as well as six years in journalism and over four years in plastics. He was at one time a sub editor on THE CHEMICAL AGE and joined *British Plastics* in 1951, becoming assistant editor last year. In addition to liaison with the technical and daily Press he will include among his new duties the editing of the illustrated quarterly *Bakelite Progress*.

The following changes have taken place in Dyehouse Division, I.C.I. Ltd., at Blackley, Manchester: MR. J. R. MADDOCKS has been appointed division staff manager designate, with a view to his appointment as division staff manager. He succeeds MR. B. A. FIXSEN who retires on 30 November. MR. F. NORTH, head of pigments section, Dyehouse Department, is now an assistant chief colourist. MR. H. LONGWORTH, head of chemical and fuel supply section, division supply department, is now an assistant supply manager. MR. J. B. KITCHIN, works manager of Trafford Park works, has been transferred to head office, London. He succeeds MR. GRANGE MOORE as deputy head of I.C.I. work study department. MR. R. T. DUNN, assistant works manager, Trafford Park works, is now works manager, Trafford Park works. MR. R. MARTIN, head of Intermediates East department, Huddersfield, has been appointed assistant works manager at Blackley, in succession to MR. D. ALLAN. MR. V. B. GERKEN, works manager, Ellesmere port works, has been appointed assistant works manager, Trafford Park. MR. R. SCOTT, head of Acids and Primaries department, Huddersfield works, is now works manager, Ellesmere Port. MR. B. E. PRITCHARD is now head of Intermediates East department, Huddersfield. MR. J. E. BARTLE succeeds MR. SCOTT as head of Acids and Primaries department at Huddersfield.

MR. ROBIN MACLELLAN, of George MacLellan & Co. Ltd. the Glasgow Rubber & Asbestos Works, Glasgow N.W., is leaving this country on 29 September for an overseas trip that will take him to New York, Montreal, Toronto, Vancouver, Fiji, New Zealand and Australia. Mr. MacLellan returns from Vancouver, on Canada's Pacific Coast, via the polar route on 20 December, 1955.

The Institute of Metal Finishing announces that the officers and council for Session 31 (1955/56) are as follows:—*president*, MR. R. A. F. HAMMOND, B.Sc., A.R.C.S., F.R.I.C., *immediate past president*, PROFESSOR J. W. CUTHBERTSON, D.Sc., F.I.M., A.M.I.E.E.; *vice-presidents*: DR. S. G. CLARKE, D.Sc., A.R.I.C., F.I.M.; DR. T. P. HOAR, M.A., Ph.D. (Cantab.), B.Sc. (Lond.), F.R.I.C., F.I.M.; DR. L. B. HUNT, M.Sc., Ph.D., A.R.C.S., F.R.I.C.; MR. R. W. NICOL; MR. H. SILMAN, B.Sc. (Lond.), F.R.I.C., M.I.Chem.E., F.I.M.; MR. A. SMART, B.Sc. MR. A. W. WALLBANK, B.Sc., F.R.I.C.; *hon. treasurer*, MR. F. L. JAMES; *hon. secretary*, DR. S. WERNICK, Ph.D., M.Sc., F.R.I.C., F.I.M.; *Members of council*: DR. G. L. J. BAILEY, Ph.D., D.I.C., F.Inst.P.; MR. W. F. B. BAKER, A.M.I.E.E.; DR. J. E. GARSIDE, M.Sc. (Tech.), Ph.D., F.R.I.C., F.I.M., M.Inst.F.; MR. A. A. B. HARVEY, M.Sc. (Lond.), A.R.I.C.; DR. D. N. LAYTON, Ph.D., M.Sc., A.R.C.S., D.I.C., A.Inst.P.; MR. L. MABLE, MR. R. T. F. MCMANUS, MR. C. WHARRAD, MR. F. WILD, A.I.M.; *ex-officio*:

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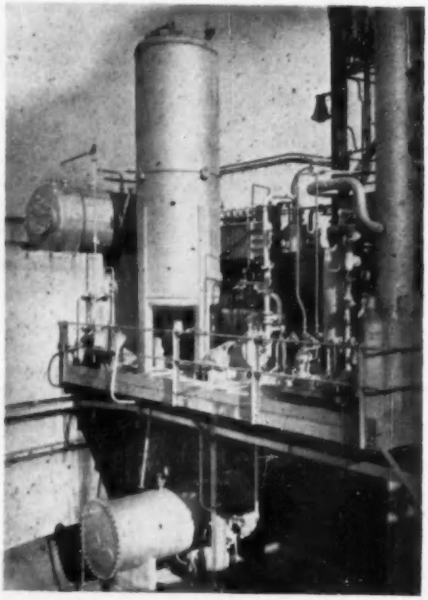
DR. E. E. LONGHURST, Ph.D., chairman, London branch; MR. L. MABLE, chairman, Midland branch; MR. W. A. BOWKER, chairman, Sheffield & North-East branch; MR. B. J. JONES, chairman, North-west branch; MR. S. A. J. MURRAY, chairman, Scottish branch; DR. W. STEIN, Ph.D., F.R.I.C., chairman, organic finishing group.

MR. R. B. HAGART has been elected a director of African Explosives & Chemical Industries in succession to MR. P. M. ANDERSON. Mr. Hagart, born in 1894 in Port Glasgow, went to South Africa when he was seven. He is deputy joint chairman of the Anglo-American Corp. of South Africa.

Obituary

After a short illness, MR. ERIC A. C. BRANCZIK, managing director of Film Cooling Towers (1925) Ltd., of Brentford, Middlesex, died on 13 September aged 43. Mr. Branczik, an associate member of the Institute of Electrical Engineers, was educated at the City of London School, Blackfriars, and at Battersea Polytechnic. He joined Film Cooling Towers in 1945, becoming managing director in 1947.



A single absorber Birlec Lectrodryer incorporated in the silicones separation plant at Midland Silicones Limited, handles 2,500 lb. ether per hour

MR. FRANCIS A. COUNTWAY, who died recently in Boston, Mass., aged 79, was, until 1945, president of the US firm of Lever Bros., a position he held for 30 years. In 1938 he was reputed to be the highest paid American with an annual salary of £117,000.

The death has occurred at Oxford of DR. SYDNEY GLENN PRESTON PLANT. Dr. Plant, who was 58, was a former lecturer and demonstrator at the Dyson Perrins laboratory, Oxford, and had been secretary to the delegates, Oxford University Museum since 1928. He was the author of papers on indoles and carbozole.

DR. THOMAS EWAN, M.Sc., Ph.D., F.Inst.P., who died at Strathblane, near Glasgow, recently, aged 87, was a pioneer of the cyanide manufacturing industry. Trained at Manchester, Munich and Amsterdam, he did university work before transferring to the Aluminium Company at Oldbury. In the early 1900's he joined the Cassel Cyanide Co. Ltd. and moved to Glasgow, later working at Billingham until 1933. In 1933 he joined a family business in Renfrew founded by his son-in-law.

The Mond Nickel Co. announce the death of MR. HOWARD EVANS, A.Met., F.I.M., superintendent of their research laboratory at Birmingham on Sunday, 11 September. Mr. Evans was born in 1907 and studied metallurgy at Sheffield University where he graduated A.Met. with the award of the Mappin Medal and Premium in 1930. In 1938 Mr. Evans joined the development and research department of the Mond Nickel Co. Ltd., as research metallurgist in their Birmingham laboratory. In 1945 he was appointed principal assistant to the superintendent, and in May 1954 superintendent of the laboratory. He was elected a Fellow of the Institution of Metallurgists in 1946, and was a member of the Iron and Steel Institute, the Institute of Metals, and other societies, to which he has presented numerous technical papers on a wide variety of metallurgical subjects. During the year 1954/55 Mr. Evans was president of the Birmingham Metallurgical Society.

Publications & Announcements

HOWARDS of Ilford Ltd. have issued a new booklet on the uses of their technical chemicals in the paint trade. It is written primarily for the paint manufacturer but their appears to be points of interest in it for all who are concerned with the manufacture or use of surface coatings. The booklet is divided into three sections. Section 1 describes solvents, plasticisers, and resins in the cellulose lacquer industry; section 2 chemicals in oil paints, varnishes and synthetic finishes; section 3 physical properties and applications of Howards' solvents, plasticisers and technical chemicals. Some useful tables on the physical and chemical properties of Howards' chemicals are also given. Anyone requiring a copy of this booklet is invited to write to Howards of Ilford Ltd., Ilford, Essex.

* * *

WHATEVER the direction of your research it is likely that Battelle can help you'. This claim is made in a booklet 'Research in Minerals Processing' published by the Battelle Memorial Institute, 505 King Avenue, Columbus 1, Ohio. Battelle say that they have on their staff experts in all phases of mining, mineral preparation, metallurgy, chemistry, physics, fuels, ceramics and engineering, together with specialists in the related technologies that have a bearing on the future of mineral products. This booklet depicts some of the facilities and equipment available at Battelle for minerals processing studies. The Battelle plan is also outlined, and how it can be used in a company's research. An abbreviated account is given of the development process for new ore bodies. A metallurgical process must be devised for the economical recovery of the valuable constituents. Sometimes the process may be merely an adaptation of one tried and proved over the years. Frequently, however, and particularly with low-grade ores, a completely new process must be devised and evaluated. According to Battelle the stages in developing process are as follows: (1) mineral identification; (2) study of physical and chemical properties; (3) development of economic concentration process; (4) new and unusual separation methods may have to be studied; (5) pyrometallurgy studies may be made; (6) special reaction equipment may be required; (7) large scale studies. Some information is also given about Battelle's more general services. In addition to pilot-plant studies, it provides many advisory services and conducts engineering-economics surveys.

* * *

FEATURED in the July/August issue now available of the Incorporated Plant Engineers' *Journal* is an article on the 'Statutory Requirements in Connection with Boilers and Other Pressure Vessels' by G. A. Anderson, A.M.I.Mech.E., M.I.Mar.E. It deals fully with all requirements of the Boiler Explosions Act and the Factories Act and traces the history of the events leading to the framing of these acts. In another article from a paper given to the Sheffield & District branch of the Incorporated Plant Engineers, A. E. Rice writes about factory floors, dealing with wood blocks, pitchmastic flooring, and magnesium oxychloride floor finishes among other types.

* * *

BRITISH Drug Houses have issued a list of additions to their catalogue for the period January to June, 1955. Further information on each individual item may be found in the leaflet 'New Entries in the BDH Catalogue' for the month or months concerned. The list includes organic and inorganic chemicals, ion exchange resins, the Lovibond Comparator, microscopical stains and reagents for clinical analysis.

* * *

TECHNICAL information on the complete range of Geon vinyl resins, latices and compounds is now available from British Geon Ltd., of London. The information, compiled in two Summary Sheets (Nos. 1 and 2), provides at-a-glance details of all vinyl materials as well as their main uses.

* * *

FEATURED in the September issue of *Road Tar*, the quarterly publication of the British Road Tar Association, is an article by Dr. J. R. Dewhurst on the uses of coal tar and its products. The article deals with production and the nature of coal tar, tar products as adhesives, as adhesives in building, and tar products as waterproofing agents and as fuels. One chapter is devoted to carbon products.

British Chemical Prices

(These prices are checked with the manufacturers, but it must be pointed out that in many cases there are variations according to quantity, quality, place of delivery, etc.)

LONDON.—Trading conditions in most sections of the chemicals market have again been fairly active with contract deliveries to the leading UK industrial consumers well up to schedule. The volume of inquiries for shipment has been on a good scale for the season. Prices show no further important changes at the time of this report but the trend is definitely harder. The call for the coal tar products remains persistent with values steady at recent levels. The market for hot pressed naphthalene appears to be strengthening.

MANCHESTER.—The undertone of prices on the Manchester chemical market is firm pretty well throughout the range. Contract deliveries of textile and other industrial chemicals during the past week have been on steady lines and fresh inquiry and actual replacement business on home consumption account has been on a fair scale, with additional bookings reported for shipment. Increased buying interest has been displayed in fertiliser materials, and both the light and heavy coal-tar products are still finding a ready outlet in most instances.

GLASGOW.—Conditions during the past week have shown a little improvement in the Scottish market. Quieter conditions are being reported from some sections of the trade but on the whole general steadiness has to be reported. Deliveries against contracts are being maintained with those applicable to spot mostly against immediate requirements. Prices generally remain firm.

General Chemicals

Acetic Acid.—Per ton : 80% technical, 10 tons, £83 ; 80% pure, 10 tons, £89 ; commercial glacial, 10 tons, £91 ; delivered buyers' premises in returnable barrels (technical acid barrels free) ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £123 per ton.

Alum.—Ground, about £25 per ton, f.o.r. MANCHESTER : Ground, £25.

Aluminium Sulphate.—Ex works, £14 15s. per ton d/d. MANCHESTER : £14 10s. to £17 15s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—2-cwt. non-returnable drums : 1-ton lots, £49 per ton.

Ammonium Chloride.—Per ton lot, in non-returnable packaging, £27 17s. 6d.

Ammonium Nitrate.—D/d, £31 per ton (in 4-ton lots).

Ammonium Persulphate. — MANCHESTER : £6 5s. per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £97 and £94 10s. per ton.

Antimony Sulphide.—Crimson, 4s. 4d. to 4s. 9½d. ; golden, 2s. 7½d. to 4s. 0¾d. ; all per lb., delivered UK in minimum 1-ton lots.

Arsenic.—Per ton, £45 to £50 ex store.

Barium Carbonate.—Precip., d/d : 4-ton lots, £41 per ton ; 2-ton lots, £41 10s. per ton, bag packing.

Barium Chloride.—£42 15s. per ton in 2-ton lots.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £42 10s. per ton d/d ; 2-ton lots, £43 per ton d/d.

Bleaching Powder.—£28 12s. 6d. per ton in returnable casks, carriage paid station, in 4-ton lots.

Borax.—Per ton for ton lots, in hessian sacks, carriage paid : Technical, anhydrous, £60 10s. ; granylar, £41 ; crystal, £43 10s. ; powder, £44 10s. ; extra fine powder, £45 10s. ; BP, granular, £50 ; crystal, £52 10s. ; powder, £53 10s. ; extra fine powder, £54 10s.

Boric Acid.—Per ton for ton lots, in hessian sacks, carriage paid : Technical, granular, £70 ; crystal, £78 ; powder, £75 10s. ; extra fine powder, £77 10s. ; BP granular, £83 10s. ; crystal, £90 ; powder, £87 10s. ; extra fine powder, £89 10s.

Calcium Chloride.—Per ton lots, in non-returnable packaging : solid, £15 ; flake, £16.

Chlorine, Liquid.—£37 10s. per ton, in returnable 16-17-cwt. drums, delivered address in 3-drum lots.

Chromic Acid.—2s. 0⅝d. per lb., less 2½%, d/d UK, in 1-ton lots.

Chromium Sulphate, Basic.—Crystals, 7⅞d. per lb. delivered (£73 10s. per ton).

Citric Acid.—1-cwt. lots, £10 5s. cwt.

Cobalt Oxide.—Black, delivered, bulk quantities, 13s. 2d. per lb.

Copper Carbonate.—3s. per lb.

Copper Sulphate.—£119 per ton f.o.b., less 2% in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £11 12s.

Formaldehyde.—£37 5s. per ton in casks, d/d.

Formic Acid.—85%, £86 10s. in 4-ton lots, carriage paid.

Glycerine.—Chemically pure, double distilled 1.260 S.G., £13 3s. 6d. to £13 14s. 6d. per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hydrochloric Acid.—Spot, about 12s. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. 3d. to 1s. 6d. per lb.

Hydrogen Peroxide.—27.5% wt., £128 10s. per ton. 35% wt., £158 per ton d/d. Carboys extra and returnable.

Iodine.—Resublimed B.P., 17s. 7d. per lb., in 28-lb. lots.

Iodoform.—£1 6s. 7d. per lb., in 28-lb. lots.

Lactic Acid.—Pale tech., 44 per cent by weight, 14d. per lb. ; dark tech., 44 per cent by weight, 8¼d. per lb., ex-works ; chemical quality, 44 per cent by weight, 12¼d. per lb., ex-works ; 1-ton lots, usual container terms.

Lead Acetate.—White : About £143 10s. per ton.

Lead Nitrate.—About £129 1-ton lots.

Lead, Red.—Basis prices per ton. Genuine dry red, £135 10s. ; orange lead, £147 10s. Ground in oil : red, £153 ; orange, £165. £165

Lead, White.—Basis prices : Dry English in 5-cwt. casks, £141 10s. per ton. Ground in oil : English, 1-cwt. lots, 178s. per cwt.

Lime Acetate.—Brown, ton lots, d/d, £40 per ton ; grey, 80-82%, ton lots, d/d, £45 per ton.

Litharge.—£137 10s. per ton, in 5-ton lots.

Magnesite.—Calcined, in bags, ex-works, about £21 per ton.

Magnesium Carbonate.—Light, commercial, d/d, 2-ton lots, £84 10s. per ton, under 2 tons, £92 per ton.

Magnesium Chloride.—Solid (ex-wharf), £16 per ton.

Magnesium Oxide.—Light, commercial, d/d, under 1-ton lots, £245 per ton.

Magnesium Sulphate.—Crystals, £16 per ton.

Mercuric Chloride.—Technical Powder, £1 5s. per lb., in 5-cwt. lots ; smaller quantities dearer.

Mercury Sulphide, Red.—£1 9s. 3d. per lb., for 5-cwt. lots.

Nickel Sulphate.—D/d, buyers UK £170 per ton. Nominal.

Nitric Acid.—80° Tw., £35 per ton.

Oxalic Acid.—Home manufacture, minimum 4-ton lots, in 5-cwt. casks, about £130 per ton, carriage paid.

Phosphoric Acid.—Technical (S.G. 1.700) ton lots, carriage paid, £92 per ton ; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 3½d. per lb.

Potash, Caustic.—Solid, £93 10s. per ton for 1-ton lots ; Liquid, £36 5s.

Potassium Carbonate. — Calcined, 96/98%, about £74 10s. per ton for 1-ton lots, ex-store.

Potassium Chloride.—Industrial, 96%, 1-ton lots, about £24 per ton.

Potassium Dichromate.—Crystals and granular, 1s. 1d. per lb., in 5-cwt. to 1-ton lots, d/d UK.

Potassium Iodide.—B.P., 14s. 1d. per lb. in 28-lb. lots ; 13s. 7d. in cwt. lots.

Potassium Nitrate.—In 4-ton lots, in non-returnable packaging, paid address, £63 10s. per ton.

Potassium Permanganate.—BP, 1-cwt. lots, 1s. 9d. per lb. ; 3-cwt. lots, 1s. 8½d. per lb. ; 5-cwt. lots, 1s. 8d. per lb. ; 1-ton lots, 1s. 7¾d. per lb. ; 5-ton lots, 1s. 7¼d. per lb. ; Tech., 5-cwt. packed in 1-cwt. drums, £8 14s. 6d. per cwt. ; packed in 1 drum, £8 9s. 6d. per cwt.

Salammoniac.—Per ton lot, in non-returnable packaging, £45 10s.

Salicylic Acid. — MANCHESTER : Technical 2s. 7½d. per lb. d/d.

Soda Ash.—58% ex-depot or d/d, London station, about £15 5s. 6d. per ton, 1-ton lots.

Soda, Caustic.—Solid 76/77% ; spot, £26 to £28 per ton d/d (4 ton lots).

Sodium Acetate.—Commercial crystals, £91 per ton d/d.

Sodium Bicarbonate.—Per ton lot, in non-returnable packaging, £15 10s.

Sodium Bisulphite. — Powder, 60/62%, £46 10s. to £49 d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—Per ton lot, in non-returnable packaging, paid address £59 5s.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Terpineol Acetate

Sodium Chlorate.—About £87 per ton normal 1-cwt. drums, carriage paid station, in 4-ton lots.

Sodium Cyanide.—96/98%, £113 5s. per ton lot in 1-cwt. drums.

Sodium Dichromate.—Crystals, cake and powder, 10¾d. per lb. Net d/d UK, anhydrous, 1s. 0½d. per lb. Net del. d/d UK, 5-cwt. to 1-ton lots.

Sodium Fluoride.—Delivered, 1-ton lots and over, £4 15s. per cwt. ; 1-cwt. lots, £5 5s. per cwt.

Sodium Hyposulphite.—Pea crystals £34 15s. a ton; commercial, 1-ton lots, £31 10s. per ton, carriage paid.

Sodium Iodide.—BP, 17s. 1d. per lb. in 28-lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £127 per ton.

Sodium Metasilicate.—£25 per ton, d/d UK in ton lots, loaned bags.

Sodium Nitrate.—Chilean Industrial, over 98% 6-ton lots, d/d station, £27 10s. September ; £28 10s. October.

Sodium Nitrite.—£32 per ton (4-ton lots).

Sodium Percarbonate.—12½% available oxygen, £8 6s. 9d. per cwt. in 1-cwt. kegs.

Sodium Phosphate.—Per ton d/d for ton lots : Di-sodium, crystalline, £37 10s., anhydrous, £81 ; tri-sodium, crystalline, £39 10s., anhydrous, £79.

Sodium Silicate.—75-84° Tw. Lancashire and Cheshire, 4-ton lots, d/d station in loaned drums, £10 15s. per ton ; Dorset, Somerset and Devon, £3 17s. 6d. per ton extra ; Scotland and S. Wales, £3 per ton extra. Elsewhere in England, excluding Cornwall, and Wales, £1 12s. 6d. per ton extra.

Sodium Sulphate (Glauber's Salt).—About £9 5s. per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER : £6 10s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot, £33 2s. 6d. per ton, d/d, in drums ; broken, £34 2s. 6d. per ton, d/d, in drums.

Sodium Sulphite.—Anhydrous, £59 per ton ; pea crystals, £37 12s. 6d. per ton d/d station in kegs ; commercial, £23 7s. 6d. per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £20 to £22, according to fineness.

Sulphuric Acid.—Net, naked at works, 168° Tw. according to quality, per ton, £10 7s. 6d. to £12 ; 140° Tw., arsenic free, per ton, £8 12s. 6d. ; 140° Tw., arsenious, per ton, £8 4s. 6d.

Tartaric Acid.—Per cwt. : 10 cwt. or more £13 15s.

Titanium Oxide.—Standard grade comm., with rutile structure, £162 per ton ; standard grade comm., £142 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d, white seal, £107 ; green seal, £105 ; red seal, 2-ton lots, £103 per ton.

Solvents & Plasticisers

Acetone.—Small lots : In 5-gal. cans : 5-gal., £125 10-gal. and upward, £115, cans included. In 40/45 gal. returnable drums, spot : Less than 1 ton, £90 ; 1 to less than 5 tons, £87 ; 5 to less than 10 tons, £86 ; 10 tons and upward, £85. In tank wagons, spot : 1 to less than 5 tons (min. 400 gal.), £85 ; 5 to less than 10 tons (1,500 gal.), £84 ; 10 tons and upward (2,500 gal.), £83 ; contract rebate, £2. All per ton d/d.

Butyl Acetate BSS.—£159 per ton, in 10-ton lots.

***n*-Butyl alcohol, BSS.**—10 tons, in drums, £143 per ton d/d.

***sec*-Butyl Alcohol.**—5 gal. drums £159 ; 40 gal. drums : less than 1 ton £124 per ton ; 1 to 10 tons £123 per ton ; 10 tons and over £119 per ton ; 100 tons and over £120 per ton.

***tert*-Butyl Alcohol.**—5 gal. drums £195 10s. per ton ; 40/45 gal. drums : less than 1 ton £175 10s. per ton ; 1 to 5 tons £174 10s. per ton ; 5 to 10 tons, £173 10s. ; 10 tons and over £172 10s.

Diacetone Alcohol.—Small lots : 5 gal. drums, £177 per ton ; 10 gal. drums, £167 per ton. In 40/45 gal. drums ; less than 1 ton, £142 per ton ; 1 to 9 tons, £141 per ton ; 10 to 50 tons, £140 per ton ; 50 to 100 tons, £139 per ton ; 100 tons and over, £138 per ton.

Dibutyl Phthalate.—In drums, 10 tons, 2s. per lb. d/d ; 45-gal. drums, 2s. 1½d. per lb. d/d.

Diethyl Phthalate.—In drums, 10 tons, 1s. 11½d. per lb. d/d ; 45 gal. drums, 2s. 1d. per lb. d/d.

Dimethyl Phthalate.—In drums, 10 tons, 1s. 9d. per lb. d/d ; 45 gal. drums, 1s. 10½d. per lb. d/d.

Dioctyl Phthalate.—In drums, 10 tons, 2s. 8d. per lb. d/d ; 45 gal. drums, 2s. 9½d. per lb. d/d.

Ether BSS.—In 1 ton lots, 1s. 11d. per lb. ; drums extra.

Ethyl Acetate.—10 tons lots, d/d, £128 per ton.

Ethyl Alcohol (PBS 66 o.p.).—Over 300,000 p. gal., 2s. 9d. ; 2,500-10,000 p. gal., 2s. 11½d. per p. gal., d/d in tankers. D/d in 40/45-gal. drums, 1d. p.p.g. extra. Absolute alcohol (75.2 o.p.) 5d. p.p.g. extra.

Methanol.—Pure synthetic, d/d, £43 15s. per ton.

Methylated Spirit.—Industrial 66° o.p. : 500 gal. and over in tankers, 4s. 10d. per gal. d/d ; 100-499 gal. in drums, 5s. 2½d. per gal. d/d. Pyridinised 64 o.p. : 500 gal. and over in tankers, 5s. 0d. per gal. d/d ; 100-499 gal. in drums, 5s. 4½d. per gal. d/d.

Methyl Ethyl Ketone.—10-ton lots, £133 per ton d/d. ; 100-ton lots, £131 per ton d/d.

Methyl *iso*Butyl Ketone.—10 tons and over £159 per ton.

***iso*Propyl Acetate.**—In drums, 10 tons, £123 per ton d/d ; 45 gal. drums, £129 per ton d/d.

***iso*Propyl Alcohol.**—Small lots : 5-gal. drums, £118 per ton ; 10-gal. drums, £108 per ton ; in 40-45 gal. drums ; less than 1 ton, £83 per ton ; 1 to 9 tons £81 per ton ; 10 to 50 tons, £80 10s. per ton ; 50 tons and over, £80 per ton.

Rubber Chemicals

Carbon Bisulphide.—£61 to £67 per ton, according to quality.

Carbon Black.—8d. to 1s. per lb., according to packing.

Carbon Tetrachloride.—Ton lots, £76 10s. per ton.

India-Rubber Substitutes.—White, 1s. 5¾d. to 1s. 9½d. per lb. ; dark, 1s. 4d. to 1s. 6¾d. per lb. delivered free to customers' works.

Lithopone.—30%, about £52 per ton.

Mineral Black.—£7 10s. to £10 per ton.

Sulphur Chloride.—British, about £50 per ton.

Vegetable Lamp Black.—£64 8s. per ton in 2-ton lots.

Vermilion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton, in 6-ton lots, d/d farmers' nearest station : September £19 12s.

Compound Fertilisers.—Per ton in 6 ton lots, d/d farmer's nearest station, I.C.I. Special No. 1. September £27 18s.

'Nitro-Chalk.'—£17 12s. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean agricultural for 6-ton lots, d/d nearest station : September, £26 5s. ; October, £26 10s.

Coal-Tar Products

Benzole.—Per gal., minimum of 200 gals. delivered in bulk, 90's, 5s. ; pure, 5s. 4d.

Carbolic Acid.—Crystals, 1s. 4d. to 1s. 6¼d. per lb. Crude, 60's, 8s. MANCHESTER : Crystals, 1s. 4½d. to 1s. 6¾d. per lb., d/d crude, 8s. naked, at works.

Creosote.—Home trade, 1s. to 1s. 9d. per gal., according to quality, f.o.r. maker's works. MANCHESTER : 1s. to 1s. 8d. per gal.

Cresylic Acid.—Pale 99/99½%, 5s. 10d. per gal.; 99.5/100%, 6s. per gal. D/d UK in bulk : Pale A.D.F. from 6s. 5d., 85 cents per US gallon, c.i.f. NY.

Naphtha.—Solvent, 90/160°, 5s. per gal ; heavy, 90/190°, 4s. 10d. per gal. for bulk 1000-gal. lots, d/d. Drums extra ; higher prices for smaller lots.

Naphthalene.—Crude, 4-ton lots, in buyers' bags, £17 5s. to £28 7s. per ton nominal, according to m.p. ; hot pressed, £40 per ton in bulk ex-works ; refined crystals, £56 10s. per ton d/d, min. 4-ton lots.

Pitch.—Medium, soft, home trade, £9 per ton f.o.r. suppliers' works ; export trade about £10 10s. per ton f.o.b. suppliers' port.

Pyridine.—90/160°, £1 2s. 6d. to £1 5s. per gal.

Toluole.—Pure, 5s. 7d. ; 90's, 4s. 10d. per gal. d/d. MANCHESTER : Pure, 5s. 7d. per gal. naked.

Xylole.—For 1000-gal. lots, 5s. 10d. to 6s. per gal., according to grade, d/d London area in bulk.

Intermediates & Dyes (Prices Nominal)

***m*-Cresol** 98/100%.—4s. 9d. per lb. d/d.

***o*-Cresol** 30/31° C.—1s. 4d. per lb. d/d.

***p*-Cresol** 34/35° C.—4s. 9d. per lb. d/d.

Dichloraniline.—4s. 3½d. per lb.

Dinitrobenzene.—88/89° C., 2s. per lb.

Dinitrotoluene.—S.P. 15° C., 2s. 0½d. per lb. ; S.P. 26° C., 1s. 4d. per lb. ; S.P. 33° C., 1s. 2d. per lb. ; S.P. 66/68° C., 1s. 10d. per lb.

***p*-Nitraniline.**—4s. 10d. per lb.

Nitrobenzene.—Spot, 9½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

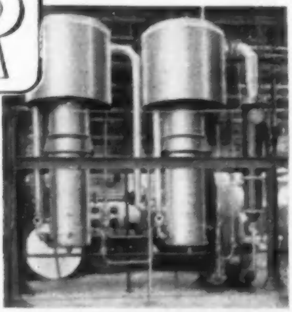
Nitronaphthalene.—2s. 1d. per lb.

***o*-Toluidine.**—1s. 10d. per lb., in 8/10-cwt. drums, drums extra.

***p*-Toluidine.**—5s. 9½d. per lb., in casks.

Dimethylaniline.—3s. 3d. per lb., drums extra, carriage paid.

BR



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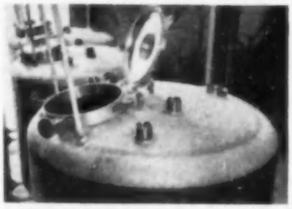

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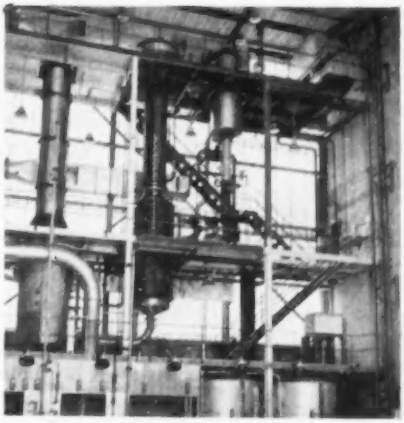

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Chemical & Allied Stocks & Shares

DESPITE an earlier rally, which embraced British Funds as well as leading industrial shares, stock markets have been very uncertain, and the rally has not been fully held. This is because there is a widespread belief that there will have to be fresh measures to check inflation.

Investment money has been going mainly into the many new issues that have made their appearance. These are largely rights offers to shareholders, and more are being predicted. Many companies want additional finance because of the fact that the banks are asking for reductions in loans and overdrafts and because of expansion plans which will require more finance. The authorities do not mind these new issues because they are largely anti-inflationary. They mean that industry is being financed rather less by the banks because the public are putting up additional money; and the aim is to get the public to spend less for the present and to invest more.

General Trend Followed

As was to be expected, shares of chemical and kindred companies have moved rather closely with the general trend on the Stock Exchange. They failed to hold an earlier rally and show in some cases moderate declines as compared with a month ago. Imperial Chemical were very active, as usual, but on balance have receded in price from 53s. a month ago to 50s. 7½d. despite the belief that the forthcoming interim statement will show that the upward trend in profits has been maintained. No change is generally expected in the interim dividend, but there are hopes in the market that a higher total for the year may be in prospect.

Despite the good impression created by the higher earnings in the half-yearly statement, Albright & Wilson 5s. shares have eased on the month from 23s. 3d. to 21s. Fisons have receded with the general trend from 59s. 9d. to 58s. and Laporte 5s. shares from 20s. 6d. to 19s. 3d. Elsewhere, Monsanto have been active, but at 29s. xd., these 5s. shares compared with 30s. 6d. a month ago.

Anchor Chemicals 5s. shares were maintained at 13s. 9d. Borax Consolidated have been a prominent feature again, accompanied by talk of American buying and by higher dividend expectations. As compared with a month ago, these shares have advanced from 130s. 9d. to 149s. 3d., a new record level.

Yorkshire Dyeware & Chemical 5s. shares at 11s. 3d. have been quite well maintained. There was considerable activity in Reichhold 5s. shares, which, however, reflected some profit taking following the interim dividend announcement, but at 20s. 9d. compared with 20s. a month ago.

Lawes Chemical 10s. shares were 16s. 6d., a rise of nearly 1s. compared with a month ago. Hardman & Holden have risen on balance from 13s. 6d. to 14s. 3d., and Hickson & Welch from 26s. 6d. to 28s. British Chrome Chemicals 5s. shares were 12s. 9d., compared with 13s. 3d. a month ago. British Glues & Chemicals at 15s. 3d. moved slightly higher on balance. Coalite & Chemical 2s. shares were 4s. 3d. compared with 4s. 6d. a month ago.

Brotherton 10s. shares moved slightly higher at 41s. Among plastics, British Xylonite have risen from 44s. to 46s. and British Industrial Plastics 2s. shares were around 6s. The 6s. 8d. units of the Distillers Co. have receded on the month from 25s. 3d. to 24s. 7½d. Boots Drug 5s. shares at 18s. 6d. have been well maintained on balance. Oils were very active, but came back sharply after their big rise. Shell, however, were 135s. 7½d., compared with 134s. 4½d. a month ago but B.P. have dropped back from 119s. 4½d. to 115s. 7½d.

Chemical Plant

PRODUCTION has begun of two patterns of the Oxythene V grade circulating pump designed by Horwich Smith & Co. Ltd., of Birmingham. One is a suction pump with a lift of eight feet, the other a circulating pump, for use in the chemical and food industries. The Oxythene acid circulating pump is fabricated throughout from corrosion resisting Oxythene V grade (PVC) material, and all pump parts exposed to corrosive liquor are PVC and absolutely resistant. The pump will handle most strong acids and chemicals up to 60° C and is available in two types, self- and non-priming.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Satisfactions

AIRFOAM FIRE PROTECTION LTD., London W.C.—Satisfactions, 23 August, of debenture registered 22 February and mortgage registered 17 March, 1950.

GRANDEUR PAINTS LTD., London W.C.—Satisfaction, 18 August, of charge registered 10 March, 1955.

Increases of Capital

VULCAN FURMIGATOR CO. LTD., manufacturers of insecticides, vermin destroyers and fumigating preparations, etc., London House, 3 New London Street, E.C.3, increased by £29,900, in £1 ordinary shares, beyond the reduced capital of £100.

P.R. CHEMICALS LTD., manufacturers of tar acids, coke, coal, tar, pitch, creosote, etc., Brettenham House, Lancaster Place, W.C.2, increased by £90,000, in £1 ordinary shares, beyond the registered capital of £60,000.

J. W. CHAFER LTD., chemical manufacturers and spraying specialists, etc., Milethorne Lane, Doncaster, Yorkshire, increased by £60,000, in £1 ordinary shares, beyond the registered capital of £40,000.

DALMAS LTD., manufacturing chemists, plastics makers, etc., Junior Street, Leicester, increased by £100,000, in £1 ordinary shares, beyond the registered capital of £150,000.

TAYLOR REESON LABORATORIES LTD., manufacturers of detergents, disinfectants, cosmetics, hairdressers' preparations, etc., 23-8 Penn Street, London W.1, increased by £5,000, in £1 seven per cent cumulative redeemable preference shares, beyond the registered capital of £5,000.

Company News

Simon-Carves Ltd.

Arrangements are in hand for a public issue by Simon-Carves of 850,000 5s. shares at 22s. each. The full prospectus is to be advertised on 26 September, and the list of applications will open and close on 29 September. The company was formed to design, build and operate by-product coke ovens for the carbonisation of coal and to sell the coal by-products. Since then it has entered other fields of heavy industrial engineering.

Quickfit & Quartz Ltd.

A member of the Triplex group of companies, Quickfit & Quartz Ltd., makers of interchangeable chemical glassware, broke all previous trading records during the last financial year. In his statement to stockholders Sir Graham Cunningham, chairman and managing director, said: 'This prosperous subsidiary has done well and, we believe, will do better still in years to come.' For the second consecutive year the board of this company has declared a dividend of 20 per cent'.

The Distillers Co. Ltd.

The directors announce that they have declared a dividend on the preference capital of the company for the six months ending 30 September, 1955, at the rate of three per cent less income tax, payable on 15 November, 1955, to stockholders on the register at 16 September, 1955.

Willows Francis Ltd.

The directors announce that the net profit for the year ended 30 June, 1955, is £38,036 (against £24,467 for the previous year), after providing for taxation of £41,339 (£39,129). They recommend a final dividend of 10 per cent making 17½ per cent for the year, compared with 12½ per cent.

Pinchin, Johnson & Associates Ltd.

The net profit of the parent company for the year ending 31 March, 1955, at £1,308,539 is a record, comparing with £1,144,327 for the previous year. Consolidated net profits also reached a record figure, being £1,902,580 for 1954/55, against £1,624,572 for 1953/54. The directors have transferred £100,000 to general reserve and recommend a final ordinary dividend of 17½ per cent, less tax, making a total of 25 per cent, less tax, for the year. During the year the company completed a plant for the manufacture of synthetic resins at the Birmingham factory which is now fully operating, and it is anticipated that the installation of a plant in the new building at the Silvertown factory to augment production of synthetic resins, varnish and media will be operating within the next few months.

West German Potash

A SPOKESMAN for the West German potash industry said in Hanover on 19 September that extensive rationalisation of the industry was needed to avoid increased production costs which might affect both home and overseas sales. The post-war plan of re-building and expansion is now completed, he said, and now reforms are needed.

Last year Western Germany produced 1,600,000 tons of potash, more than double the quantity produced in the Federal Republic area in 1938, and output for the first half of this year was, at 837,000 tons, 156,000 tons more than in the first six months of 1954.

West German potash fertiliser prices had not been altered since 1952 although wages had twice risen since then. A rise in prices as a result of further wage increases could, predicted the spokesman, be avoided only if production and processing were rationalised which was now necessary in the interests of the country's agriculture which bought about 900,000 tons a year.

Nitrogen Fixation

PHOTOSYNTHESIS of sugar in leaves is an essential step in nitrogen fixation in the roots of leguminous plants, two University of Wisconsin scientists reported on 7 September at the annual meeting of the American Institute of Biological Sciences.

The scientists, Michael K. Bach and Professor Robert H. Burris, said that experiments have proved that sucros is pumped to plant roots from the leaves and is used in nitrogen fixation. Bach and Burris also verified the logical conclusion that, since nitrogen fixation is dependent on sugar manufacture it takes place during the day.

Tracer techniques involving the use of carbon-14 were used in the investigation.

Indian Fertiliser Plant

A NEW PLANT is to be set up at Nangal in India for the manufacture of fertilisers and heavy water. Mr. B. C. Mukherjee, who was in charge of the fertiliser plant at Sindri, will be in charge of the construction of the new factory, which is expected to go into production in September 1959.

The fertiliser produced at Nangal will be called Nangal salt and it is claimed that it will be one of the most potent as well as the cheapest sources of nitrogen.

The new factory will have a capacity of 70,000 tons of nitrogen or 340,000 tons of diluted ammonium nitrate per year. The project will cost about Rs.220,000,000.

Visiting North America

ON 20 September, Sir Graham Cunningham, chairman and managing director of the Triplex Safety Glass Co. Ltd., and the company's research director, Dr. Allan C. Waine, left London for a ten-day tour of Canada and the US. The trip will be partly to study the manufacture of safety glass in North America.

Sir Graham will also discuss the manufacture of gold-film glass which is fitted to high-flying aircraft, in which icing-up is a problem. The windscreen has a coating of transparent gold film on its surface and is electrically heated. He plans also to see agents of Quickfit & Quartz Ltd., a subsidiary of Triplex, which makes laboratory glassware.

Next Week's Events

TUESDAY 27 SEPTEMBER

Incorporated Plant Engineers

Cardiff: South Wales Engineers' Institute, Park Place, 7.15 p.m. 'Space Heating' by W. M. Barber, M.A., A.M.I.Mech.E.

SCI (Plastics & Polymer Group)

Birmingham: The Birmingham & Midland Institute, 6.30 p.m. 'Polymers Containing Fluorine' by Dr. J. Gadsby, Imperial Chemical Industries Ltd.

WEDNESDAY 28 SEPTEMBER

Incorporated Plant Engineers

Sheffield: Grand Hotel, 7.30 p.m. 'Steelmaking & the Plant Engineer' by R. Mayorcas, British Iron & Steel Institute.

FRIDAY 30 SEPTEMBER

Incorporated Plant Engineers

Birmingham: Imperial Hotel, 7.30 p.m. 'The Do's and Don't's of Refrigeration' by Malcolm E. Lea.

SCI (Food Group)

Stirling: Joint meeting with Stirling & District section in the Oak Room, Golden Lion Hotel, 7 p.m. 'The Characterisation and Properties of Wild Yeasts of Importance to the Food Industry' by Dr. E. O. Morris, B.Sc., Ph.D., M.I.Biol.

CLASSIFIED ADVERTISEMENTS

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through a Local Office of the Ministry of Labour or a Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive, or a woman aged 18-59 inclusive, unless he or she, or the employment, is excepted from the provisions of the Notifications of Vacancies Order, 1952.

ASSISTANT WORKS CHEMIST required by Telephone Manufacturing Co., Ltd., to be responsible to the Chief Chemist with problems arising at our St. Mary Cray, Kent, works in connection with materials and finishes. B.Sc. or A.R.I.C. essential. Pension and bonus scheme after qualifying period.

Write fully, stating age, experience, and salary required to:—

Personnel Manager
TELEPHONE MANUFACTURING CO., LTD.
Martell Road.
West Dulwich, S.E.12.

JAMES A. JOBLING & CO., LTD., Manufacturers of "Pyrex" Glassware, wish to make an appointment in their newly formed Electronic Products Development Department. Applications will be welcomed from **PHYSICISTS** possessing an Honours Degree, whose achievements indicate an ability to carry through developments to the production stage. This permanent, pensionable appointment off rs excellent prospects.—Write stating age, experience, and salary required to Personnel Manager, **JAMES A. JOBLING & CO., LTD., WEAR GLASS WORKS, SUNDERLAND.**

NORTH THAMES GAS BOARD invites applications from **CHEMISTS,** who have obtained a First or Second Class Honours Degree, for vacancies at its Chemical By-Products Works, Beckton, East Ham, E.6. for research on problems in connection with coal tar distillation, and the manufacture of phenols, naphthalene and bases.

Preference will be given to those who have had some post-graduate experience in research particularly in subjects related to those mentioned above.

These are permanent appointments and offer good prospects of advancement.

Successful candidates will be required to join the Staff Pension Scheme. Starting salaries will be according to age and qualifications.

Applications giving age and full details of training and qualifications should be addressed to the Staff Controller, North Thames Gas Board, 30 Kensington Church Street, W.8., to reach him by not later than 14 days after the publication of this advertisement, quoting reference 666/288.

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